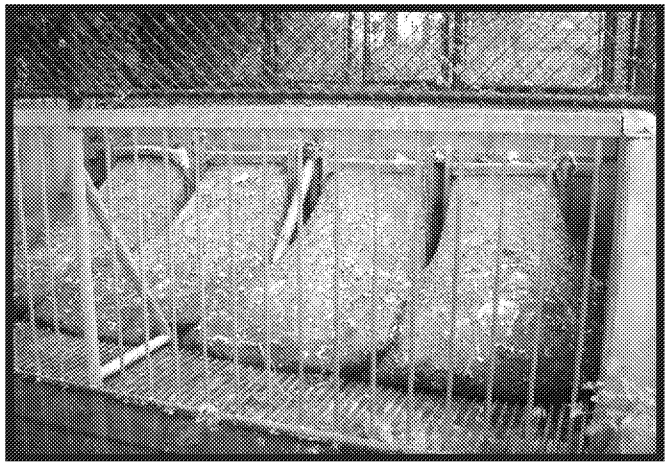
Anacostia Trash TMDL-Related Baseline Conditions Monitoring (June 2008 - July 2009)



Prepared by:

Metropolitan Washington Council of Governments,
Department of Environmental Programs

Prepared for:

Montgomery County
Department of Environmental Protection
and
Prince George's County
Department of Environmental Resources

October 23, 2009

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Acknowledgements

The authors wish to thank a number of organizations and individuals for their many contributions to this project. First and foremost, we would like to thank both the Montgomery County Department of Environmental Protection (MCDEP) and Prince George's County Department of Environmental Resources (PGDER) for providing the financial support necessary to make this project possible. Furthermore, we wish to especially thank Ms. Meo Curtis (MCDEP) and Dr. Mow-Soung Cheng and Mr. Darnaye Hines (both PGDER), for providing technical coordination and guidance and assisting COG staff. Also, the trash fence installations could not have been possible without the important assistance from the Maryland-National Capital Park and Planning (M-NCPPC) (Mr. Doug Redmond, Mr. Mike Little and Ms. Laura Connelly), the Montgomery County Department of Public Works and Transportation (Mr. James Hawkes), and the Beltsville Agricultural Research Center (Mr. David Prevar and Mr. George Myers). Next, the authors would like to thank the Interstate Commission on the Potomac River Basin (Mr. Jim Cummins, Mr. Jan Ducnuigeen, and Mr. Adam Griggs) for their excellent and timely completion of the stream survey portion of the project. Finally, the authors would like to extend their appreciation to COG staff members Mr. Stuart Freudberg and Dr. Edward Graham (both COG) who provided support during the course of this project.

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Executive Summary

The purpose of this study was to provide comprehensive, baseline trash condition data for both the Montgomery and Prince George's County portions of the Anacostia River watershed for subsequent use, by the Maryland Department of the Environment (MDE), in the development of a trash total maximum daily load (TMDL). In order to accomplish the preceding objective, a one-year study featuring the following five major tasks or elements was employed by the Metropolitan Washington Council of Governments (COG): 1) preparation of a project monitoring quality assurance project plan (QAPP) report; 2) seasonal in-stream baseline trash level assessments of the Anacostia tributary system at 30 randomly selected sites; 3) baseline road and parking lot area trash monitoring to help characterize wet weight loading rates from six representative land use types; 4) companion baseline trash monitoring of associated storm drain outfalls to help characterize wet weight loading/delivery rates from the six representative land use types; and 5) trash monitoring for two Fresh Creek Netting Trashtrap® sites located in Prince George's County to help characterize wet weight loading rates from the associated upstream drainage areas and land uses.

Six sites were selected for the road and parking lot, and associated storm drain outfall monitoring. The six sites were selected on the basis of their representativeness of following major Anacostia land use types: low-density residential (large lot, ~ 1 acre single family), medium-density residential (small lot, 1/8 acre single family and townhouses), high-density residential (garden apartments), commercial and industrial (Table 1).

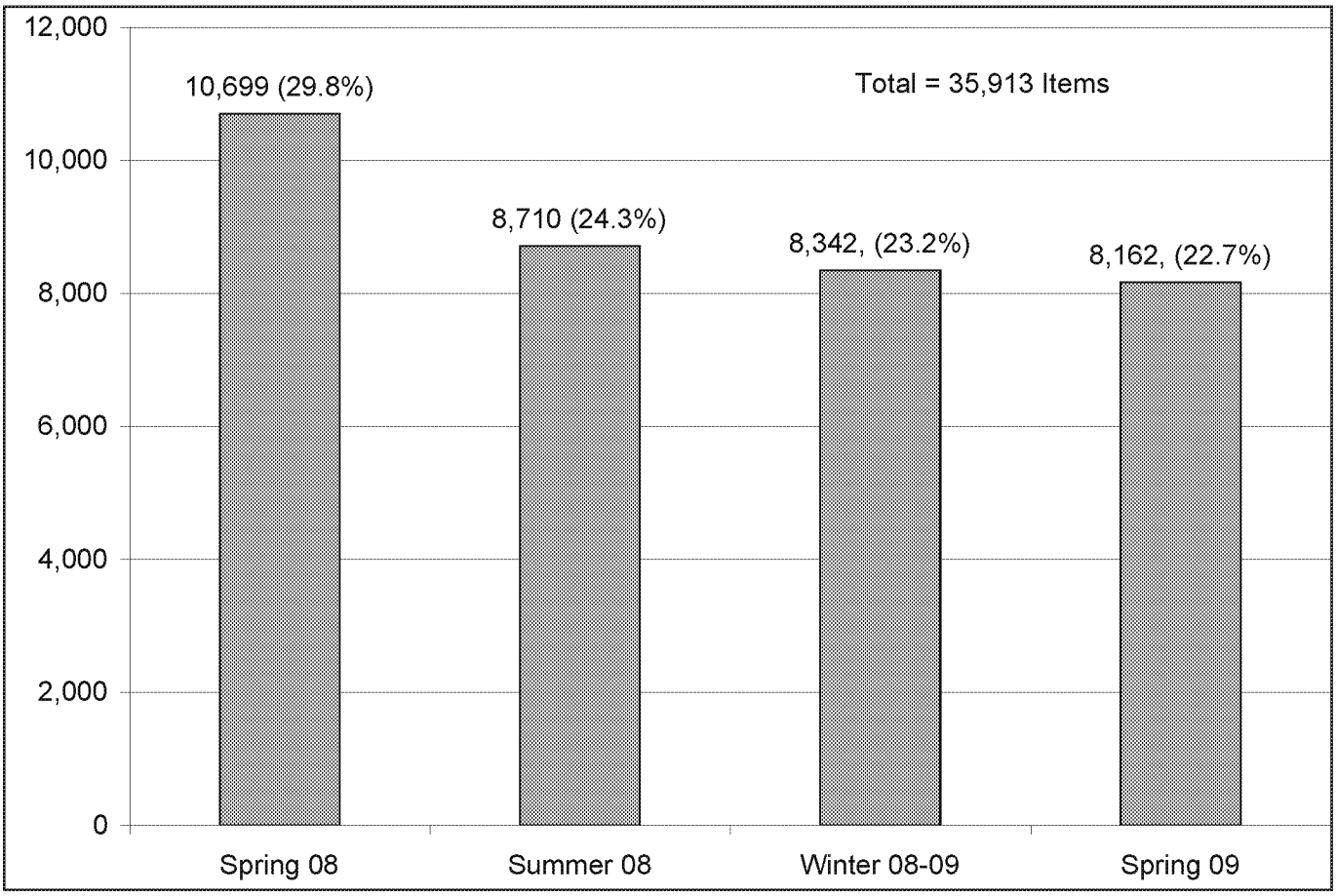
Table 1. Road and Parking Lot, and Storm Drain Outfall Monitoring Sites

Site ID	Jurisdiction	Site Description	Dominant Land use Type	Drainage Area (acre)
NWB-SD1	MC	Baughman Drive and Baughman Court	Low-Density Residential (large lot, ~ 1 acre single family) (99%)	6.9
SC-SD2	PG	Raydale and Dayton Roads - Raydale Road Tributary	Medium Density Residential (small lot, 1/8 acre single family) (76%)	65.2
LPB-SD1	MC	Silver Spruce Circle - Silverwood Tributary	Medium Density Residential (townhouses) (100%)	2.3
NWB-SD2	PG	Kirkwood Apartments - Nicholson Lane and The Mall Road	High Density Residential (garden apartments) (100%)	3.1
SC-SD1	MC	Kemp Mill Shopping Center - Magruder's Grocery Parking Lot	Commercial (100%)	4.2
IC-SD1	PG	Beltsville Industrial Park	Industrial / Commercial (57%)	226.0

Stream Monitoring

A total of 35,913 trash items were counted at the 30 stream monitoring stations. As seen in Figure 1, seasonal variability during the study period was relatively small. The difference in spring 2008 versus spring 2009 numbers is likely due to year-to-year variability in trash loading rates. Not surprisingly, multiple years of monitoring may be required to elucidate associated anthropogenic and non-anthropogenic factors.

Figure 1 - Stream Summary - Trash Items Counted and Percent of Total



A total of 1,225 trash items were counted as part of the road and parking lot monitoring (Table 2). The Beltsville Industrial Park and the Kemp Mill Shopping Center survey sites had the highest total counts at 497 items (41 percent) and 343 items (28 percent), respectively. The number of trash items per 100 feet for these industrial and commercial land use sites were also the highest at 82.3 and 57.2, respectively. Per the ATRW trash index, both industrial and commercial land use sites fell into the 'high' trash category (i.e., > 50.1 items/100 feet). For the Raydale Road, Silver Spruce and Kirkwood Apartments sites, the number of items per 100 feet were 22.7, 17.8 and 19.2, respectively, which placed them in the 'light' trash category. The Baughman Drive site (low density, large lot single family residential) site generated a survey low of 27 items or 4.5 trash items per 100 feet (i.e., 'very light' trash level category).

Table 2 - Summary - Road and Parking Lot Site Description, Trash Items[1] Count and Weight

Site ID	Subwatershed	Juris-diction	General Site Description	Dominant Land Use	Road/Parking Lot Survey		Items Counted					Weight			
							Total	Top 6 Categories		Mean Trash Items per 100 feet[2]	Mean Trash Items per Acre	Total (lbs)	Top 6 Categories		Mean Weight per Acre
				Type	Length (ft)	Area (ft^2)		Top 3	Next 3				Top 3	Next 3	
NWB-SDR1	Northwest Branch	MC	Baughman Drive	Low-Density Residential (large lot, ~ 1 acre single family)	600	6,000	27	6, 9, 4	20, 2, 3	4.5	2.9	0.8	3, 6, 9	20, 2, 3	0.1
SC-SDR2	Sligo Creek	PG	Raydale Road	Medium Density Residential (small lot, 1/8 acre single family)			136	6, 9, 20	13, 2, 4	22.7	14.5	5.1	13, 6, 9	3, 2, 20	0.5
LPB-SDR1	Little Paint Branch	MC	Silver Spruce Townhouses	Medium Density Residential (townhouses)			107	6, 9, 20	7, 1, 2	17.8	11.4	3.7	7, 6, 20	13, 8, 3	0.4
NWB-SDR2	Northwest Branch	PG	Kirkwood Apartments	High Density Residential (garden apartments)			115	6, 20, 9	4, 1, 2	19.2	12.3	2.1	20, 7, 4	2, 6, 8	0.2
SC-SDR1	Sligo Creek	MC	Kemp Mill Shopping Center	Commercial			343	6, 9, 1	4, 5, 20	57.2	36.6	3.9	13, 9, 6	1, 20, 4	0.4
IC-SDR1	Indian Creek	PG	Beltsville Industrial Park	Industrial/Commercial			497	20, 9, 6	2, 4, 16	82.8	53.0	39.1	20, 16, 10	2, 3, 4	4.2
							1,225	6,9,20	4,2,1	34.0	21.8	54.7	20, 16, 10	13, 3, 2	1.0

[1] Trash Item Categories:
1) Plastic Bags 2) Plastic Bottles; 3) Glass Bottles; 4) Aluminum Cans; 5) Styrofoam (cups, packaging etc.); 6) Paper (newspaper, magazines, etc.); 7) Cardboard; 8) Cloth/Clothing/Carpeting; 9) Food Packaging; 10) Auto (a) Oil Quart Containers; b) Oil Filters Antifreeze; c) Containers d) Body Parts Large >1ft^2; and e) Body Parts Small <1ft^2); 11) Car Batteries; 12) Tires (Cars, Truck); 13) Construction Debris: (a) Bricks (>1/2 brick); b) Concrete; c) Lumber; and d) Misc. (e.g. dry wall, etc)); 14. Appliances; 15) Wooden Pallets; 16) Metal (Drums, Cans, Pipes, etc.); 17) Shopping Carts; 18) Toiletries/Drug Containers; 19) Sports Equipment/Toys; and 20) Miscellaneous.

[2] 1998 ATRW Trash Index - Verbal Ranking = No. of Items/100 ft: None - Very Light = 0 - 10.0; Light = 10.1 - 25.0; Moderate = 25.1 - 50.0; and High = >= 50.1

The total number of trash items (counted and sorted to the 20 MDE-approved trash categories) was 2,913. The associated total weight was 154.5 pounds. The top six items by count, in descending order, were Styrofoam, food packaging, plastic bags, plastic bottles, miscellaneous items, and aluminum cans. It should be noted that with the exception of the miscellaneous items, the top six storm drain outfall trash items by count results were similar to those for the stream monitoring survey. The associated top six items by weight were plastic bags, plastic bottles, Styrofoam, miscellaneous items, food packaging and construction debris. The total organic weight was 912.8 pounds and the organic weight to trash weight ratio was approximately 6:1.

Table 3 - Summary - Road and Parking Lot Site Description, Trash Items[1] Count and Weight

Site Description (Jurisdiction)	Dominant Land use Type	Drainage Area (acre)	Items Counted			Weight			Organic	
			Total	Top 6 Categories		Total (lbs)	Top 6 Categories		Total Organic Weight (lbs)	Total Organic to Trash Weight Ratio
				Top 3	Next 3		Top 3	Next 3		
Baughman Drive and Baughman Court (MCCO)	Low-Density Residential (large lot, single family) (99%)	6.9	21	9, 1, 2	6, 5, 4	2.3	13, 17, 1	20, 4, 6	42.9	18:1
Raydale and Dayton Roads - Raydale Road Tributary (PGCO)	Medium Density Residential (small lot, single family, and/or townhouses) (76%)	65.2	810	9, 5, 1	20, 3, 2	50.4	1, 20, 2	16, 9, 4	173.7	3:1
Silver Spruce Circle - Silverwood Tributary (MCCO)	Medium Density Residential (small lot, single family, and/or townhouses) (100%)	2.3	195	9, 1, 2	5, 6, 20	12.0	19, 2, 9	8, 1, 4	133.8	11:1
Kirkwood Apartments - Nicholson Lane and The Mall Road (PG CO)	High Density Residential (apartments) (100%)	3.1	144	9, 1, 6	20, 5, 2	3.9	3, 2, 20	1, 9, 4	27.2	7:1
Kemp Mill Shopping Center - Magruder's Supermarket Parking Lot (MCCO)	Commercial (100%)	4.2	98	6, 9, 1	3, 20, 4	1.5	1, 3, 9	2, 20, 4	98.7	65:1
Beltsvile Industrial Park - Hanna Road (PGCO)	Commercial/Industrial (57%)	226.0	1,645	5, 1, 9	2, 4, 20	84.2	1, 5, 2	9, 13, 4	436.5	5:1
			2,913	5,9,1	2,20,4	154.5	1,2,5	20,9,13	912.8	

[1] Trash Item Categories:
1) Plastic Bags 2) Plastic Bottles; 3) Glass Bottles; 4) Aluminum Cans; 5) Styrofoam (cups, packaging etc.); 6) Paper (newspaper, magazines, etc.); 7) Cardboard; 8) Cloth/Clothing/Carpeting; 9) Food Packaging; 10) Auto (a) Oil Quart Containers; b) Oil Filters Antifreeze; c) Containers d) Body Parts Large >1ft^2; and e) Body Parts Small <1ft^2); 11) Car Batteries; 12) Tires (Cars, Truck); 13) Construction Debris: (a) Bricks (>1/2 brick); b) Concrete; c) Lumber; and d) Misc. (e.g. dry wall, etc)); 14. Appliances; 15) Wooden Pallets; 16) Metal (Drums, Cans, Pipes, etc.); 17) Shopping Carts; 18) Toiletries/Drug Containers; 19) Sports Equipment/Toys; and 20) Miscellaneous.

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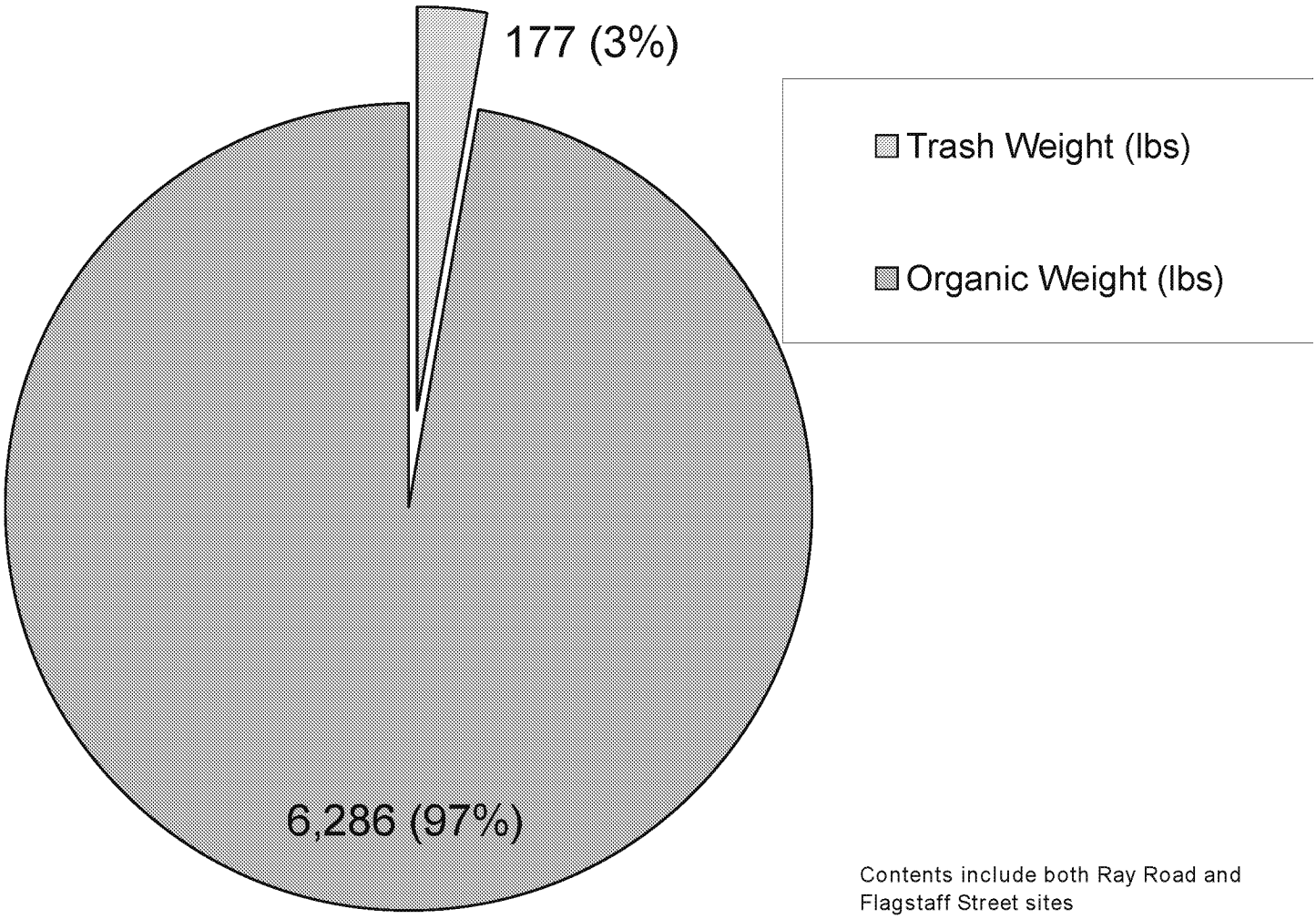
Fresh Creek Netting Trashtrap® System Monitoring

Two Fresh Creek Netting Trashtrap® systems, both of which are located in Prince George's County, were monitored. The 659-acre Ray Road system which is located in the Takoma Branch (i.e., a tributary to Sligo Creek), employs five nets with 0.5-inch openings. The 40.8-acre Flagstaff Street system, which is located in the Lower Beaverdam Creek subwatershed, employs four nets with 0.5-inch openings.

For the Ray Road netting system, a total of 1,490 trash items weighing 110 pounds were collected. The top six items by count, in descending order, were food packaging, plastic bags, plastic bottles, Styrofoam, miscellaneous items, and aluminum cans. The leafy organic material weight collected at this site totaled 4,768 pounds. This represented 98 percent of the total weight, 4,878 pounds. The ratio of organic material to trash, by weight, was 43.5:1.

For the Flagstaff Street netting system, a total of 1,276 trash items weighing 67 pounds were collected. The top six items by count, in descending order, were food packaging, plastic bottles, miscellaneous items, plastic bags, aluminum cans, and paper. The leafy organic material weight collected at this site totaled 1,518 pounds. This represented 95 percent of the total weight, 1,585 pounds. The ratio of organic material to trash, by weight, was 22.8:1.

Figure 2 - Ray Road and Flagstaff Street - Combined Total Trash and Organic Debris Weights (Pounds)



Recommendations

Stream Monitoring

1. Repeat the stream monitoring surveys for the summer and early fall (before leaf fall) seasons, and remove trash from the stream stations as part of each survey. This would provide both needed accumulation rate data and a larger dataset.

Road and Parking Lot Monitoring

1. Continue monitoring the six road and parking lot areas in the current study for one more year. This would provide more representative results and would better account for both annual and seasonal precipitation variations;
2. Conduct a 'mark and recapture' survey for selected road and parking lot areas. This would provide more information as to how floatable trash items enter the watershed's storm drainage systems;
3. Perform a one-year, four season "windshield" survey of major roads within the Maryland portion of the Anacostia watershed (i.e., approximately 500-800 miles). This would provide both badly needed roadway trash level data and help identify "hot spot" areas for subsequent trash removal activities. With proper training to standardize protocols, this could be performed by trained volunteers; and
4. Conduct a comprehensive survey of apartment management firms in the watershed to help better quantify the amount and type of litter/trash removal activities associated with this land use type.

Storm Drain Monitoring:

1. Conduct a 'mark and recapture' survey specifically for the six storm drain outfall sites monitored in the current study and their associated receiving stream areas. As part of this monitoring effort, one or more additional recording rain gauges should be installed. This proposed monitoring effort would provide more information as to how floatable trash items are transported within the Anacostia tributary system.

Fresh Creek Netting TrashTrap® System Monitoring

Recommended Monitoring/Evaluation for the Ray Road Site:

1. The galvanized steel channel frames that hold the bag frames appear to still be serviceable. Install four new, 300 cfs bags; leaving the left (looking upstream) cell open;
2. Install a temporary/experimental flow diversion weir consisting of 2-3, 6" x 6" pressure treated wood posts (or equivalent) bolted in between the existing metal trash net frame. This weir should be about 6" above the invert of the concrete pad to let the Takoma Branch baseflow and some of the sand and gravel bedload flow through;
3. Remove most, if not all of the existing bypass grating system; and
4. Monitor the bags (using different types, including the resin coated ones) and weir for at least 6 months to see if this system really works better than the old one. Also, install a recording rain gauge in the catchment and a pressure transducer in the stream (to determine flow/stage). Only after completing this monitoring should a final decision on next steps (including a possible major rebuild, or a completely new approach) be made.

Montgomery and Prince George's Counties Trash Reduction

1. Both Montgomery County and Prince George's County should investigate working with homeowner associations and community groups in medium density residential areas to reduce litter and trash loadings via the employment of educational outreach and low-cost structural measures, such as storm drain inlet grates. A phased approach whereby community members are first engaged in placing storm drain markers on their inlets, followed by possible installation (by the County or other) of storm drain inlet grates is further recommended; and
2. Prince George's County should strongly encourage private businesses and local groups to 'adopt-a-road' or 'adopt-a-block' within the Beltsville Industrial Park area. In addition, it should explore expanding the current "Four Cities" street sweeping program to include the Beltsville Industrial Park and U.S. Route 1 corridor in Beltsville.

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1.0 Introduction

The purpose of this study was to provide comprehensive, baseline trash condition data for both the Montgomery and Prince George's County portions of the Anacostia River watershed for subsequent use, by the Maryland Department of the Environment (MDE), in the development of a trash total maximum daily load (TMDL). In order to accomplish the preceding objective, a one-year study featuring the following five major tasks or elements was employed by the Metropolitan Washington Council of Governments (COG): 1) preparation of a project monitoring quality assurance project plan (QAPP) report; 2) seasonal in-stream baseline trash level assessments of the Anacostia tributary system at 30 randomly selected sites; 3) baseline road and parking lot area trash monitoring to help characterize wet weight loading rates from six representative land use types; 4) companion baseline trash monitoring of associated storm drain outfalls to help characterize wet weight loading/delivery rates from the six representative land use types; and 5) trash monitoring for two Fresh Creek Netting Trashtrap™ sites located in Prince George's County to help characterize wet weight loading rates from the associated upstream drainage areas and land uses. It is important to note that many individuals and organizations were involved in the study and that it was coordinated closely with the Montgomery County Department Environmental Protection (MCDEP), Prince George's County Department of Environmental Resources (PGDER), MDE, the Interstate Commission on the Potomac River Basin (ICPRB) and public landowners and entities such as the Maryland-National Capital Park and Planning Commission (M-NCPPC), Montgomery County Department of Public Works and Transportation (DPW&T) and the United Stated Department of Agriculture, Beltsville Agricultural Research Center (USDA - BARC).

2.0 Task Descriptions and Methodology

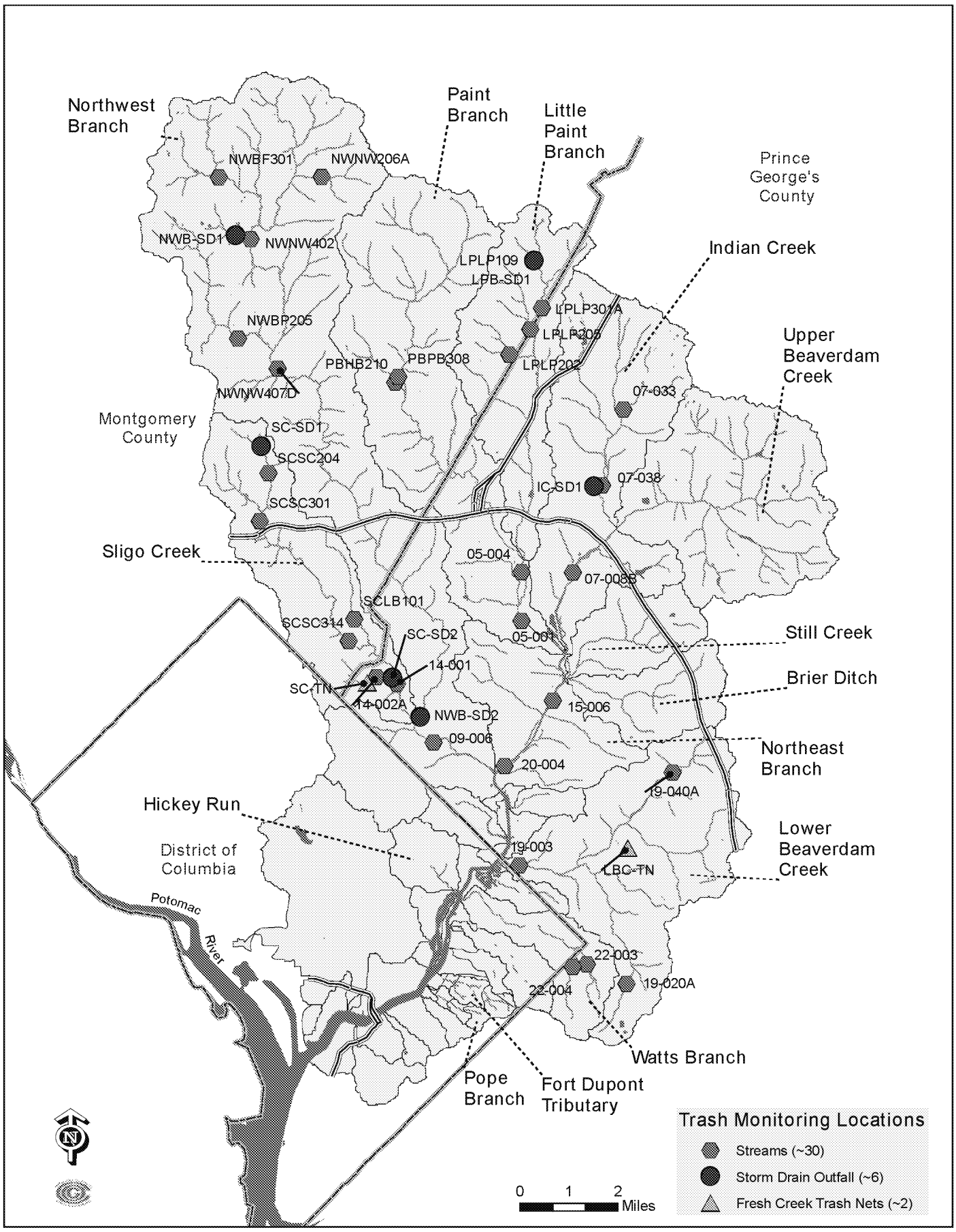
Under Task 1, COG developed a quality assurance project plan for the baseline trash surveying protocols. Working from the 1998 Anacostia Trash Workgroup Stream Trash Surveying Methodology and Indexing System, developed by COG, the Anacostia baseline trash survey protocol was updated to reflect comments received from the current Anacostia Trash Reduction Workgroup (ATRW). The new 2009 trash protocols feature: 1) a methodology for four distinct trash-related survey types (i.e., streams, roads and parking lots, storm drain outfalls and Fresh Creek Netting Trashtrap® systems), and 2) an expanded trash items list to include a total of 20 trash categories, and 3) a weight measuring component for each of the categories. The survey protocols along with the new field data sheet were tested by MDE and COG staff in winter 2007, and subsequently approved for use by MDE, MCDEP and PGDER prior to actual project implementation in spring 2008. For more information, Appendix 1 details the Anacostia TMDL baseline stream-related trash data QAPP protocol, as well as site coordinates and their general descriptions. In addition, Figure 1 summarizes the 30 stream, six road and parking lot, six storm drain outfall and two Fresh Creek Netting Trashtrap® system survey locations.

Tasks 2-5 and associated results are described in detail in the following sections of the report.

2.1 Stream Monitoring (Task 2)

Working closely with the ATRW, COG first generated the 30 random stream survey sites (i.e., 15 in Montgomery County and 15 in Prince George's County) from a prospective candidate pool of 161 MCDEP and PGDER Anacostia biological monitoring stations. Second, COG subcontracted with the ICPRB to assist in the stream survey portion of the study. In order to assure consistency in sampling approach, a series of training sessions were conducted by COG for the ICPRB that included in-stream survey protocols, site access, data entry, related summaries, etc. The in-stream baseline trash survey was performed once per season (i.e., spring 2008, summer 2008, winter 2008-09, and spring 2009). It should be noted that, due to both the high number of leaves and associated leaching of tannins which obscured stream bed visibility (note: the trash survey is a visible count-based survey), the fall 2008 sampling season was omitted. Upstream and downstream GPS coordinates were generated for each of the 30 selected monitoring sites. As part of the survey, the total number of observed trash items were

Figure 1 - Project Trash Monitoring Locations



recorded and catalogued according to 20 types (e.g., plastic bags, plastic bottles, glass, aluminum cans, Styrofoam material, car tires, etc.) on the field survey form. The length of each survey reach was 500 feet long, and was measured through the employment of a Walktax® Distance Measurer. Additional information regarding the stream monitoring protocol is included in Appendix 1 and 2.

Table 1. Road and Parking Lot, and Storm Drain Outfall Sites

Site ID	Jurisdiction	Site Description	Dominant Land use Type	Drainage Area (acre)
NWB-SD1	MC	Baughman Drive and Baughman Court	Low-Density Residential (large lot, ~ 1 acre single family) (99%)	6.9
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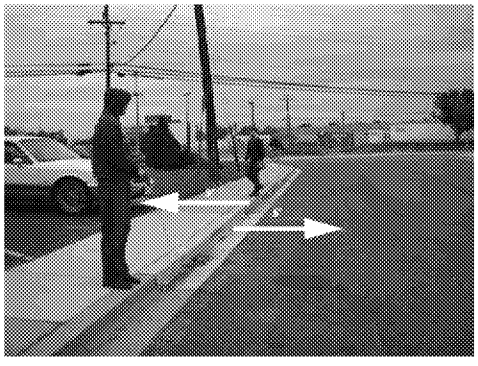
NWB-SD2	PG	Kirkwood Apartments - Nicholson Lane and The Mall Road	High Density Residential (garden apartments) (100%)	3.1
SC-SD1	MC	Kemp Mill Shopping Center - Magruder's Grocery Parking Lot	Commercial (100%)	4.2
IC-SD1	PG	Beltsville Industrial Park	Industrial / Commercial (57%)	226.0

2.2 Road and Parking Lot Monitoring (Task 3)

A total of five road and one parking lot sites (i.e., six sites total, with three located in Montgomery County and three in Prince George's County) were monitored by COG. The six sites were selected on the basis of their representativeness of major Anacostia land use types (Table 1). At each site, a representative 300 foot-long road (or parking lot) section was monitored. A 10-foot wide area, both five feet inside and five feet outside of the road gutter pan (Figure 2), was surveyed on both sides of the 300-foot long roadway area. This resulted in a total of 6,000 square feet sampled per monitoring site. All trash items within this area were removed, sorted, weighed and catalogued into one of the 20 generic trash categories. Additional information regarding the road and parking lot monitoring protocol is provided in Appendix 1.

Figure 2 - Measuring for Road Survey



2.3 Storm Drain Outfall Monitoring (Task 4)

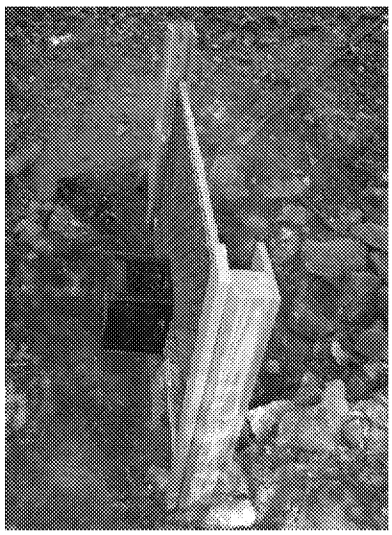
Prior to actual monitoring at each of the six storm drain outfall sites, COG first installed (after obtaining written permission from the landowner) a semi-permanent chain link trash fence. Specific site considerations were taken into account for each trash fence design and installation. While it was necessary to tailor each trash fence specifically to each site, all six trash fence designs shared some common elements: 1) a two-inch diameter opening chain link fence to capture trash and 2) a one cubic foot (with a one-inch diameter opening) sub-sampler affixed to the bottom center of the fence (Figure 3). Five of the fences were designed with removable or hinged gates and one was of the fixed variety. The five removable or hinged gate systems were secured using padlocks and chain to discourage vandalism and to provide a strong anchor for holding the gates in the closed position.

Another major design consideration at each trash fence location was adequate distance downslope of the storm drain pipe outfall. This was critical for preventing back-up, should the trash fence become blocked with trash and debris, and potential flooding of the storm drain system. Based on previous COG stormflow discharge observations, three of the trash fences (i.e., Silver Spruce, Raydale Road and Beltsville Industrial Park sites) were constructed using a breakaway chain link fence design feature. This design feature allowed major stormflows to

Figure 3 - Trash Fence With Sub-Sampler In The Closed Position - Baughman Drive Site

pass through the trash fence without either completely destroying the chain link fencing and/or support posts, or causing flooding-related problems. This break-away system employed 75 pound tensile strength, electrical plastic ties secured along both the bottom and sides of the fence. Under high water pressure, the ties snapped allowing the chain link panel to swivel upwards without being damaged. Complementing this breakaway feature was an additional stone-lined or sand-bagged overflow area (for safely bypassing high stormwater flows around the sides of the fences without either damaging them or creating localized erosion problems).

Figure 4 - Trash Fence with Removable Panel



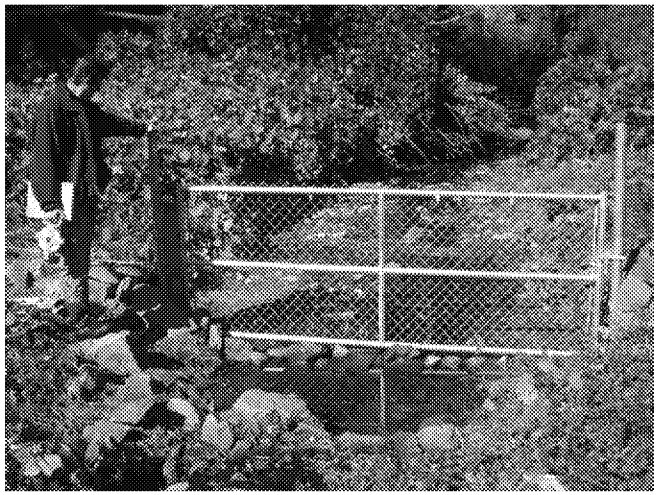
Due to the high variability in drainage area size and associated stormflow discharge (as well as other site constraints), the same trash fence design could not be used at each of the six sites. As such, three generic trash fence designs were employed. The first and most preferred of these was the removable trash fence panel, which was used at three of the smaller outfall sites (i.e., drainage area under 10 acres). This design allowed for quick removal of the fence after sampling. It featured two, four-inch by four-inch slotted support posts augured into the sides of the outfall channel. A six foot by three foot aluminum chain link fence panel was inserted between the two posts, flush with the bottom of the channel. The chain link fence used had a diameter of two inches (Figure 4). The sub-sampler (e.g., one cubic foot milk crate with one-inch diameter openings) was attached to the downstream side of the fence. The purpose of the sub-sampler was to capture small fugitive trash items (less than two inches) that were not captured by the larger two-inch mesh chain link fence.

A second and less-preferred alternative design for smaller drainage areas (i.e., less than 5 acres) featured a fence in the permanently 'closed' position. This fence was installed as potential flooding and backwater issues was not a major concern. The fence featured two-inch diameter opening chain link fence supported at every two to four feet by a steel post (Figure 5).

A third design type was employed for the two largest drainage areas (i.e., greater than 50 acres). This design consisted of a custom fabricated, heavy duty swinging steel gate(s). The hinged gate panels were attached to heavy gauge steel posts located along the bottom edge of the channel. Large boulder-sized stones and/or sandbags were employed along the bottom and sides of these two trash fences to fill the voids spaces and/or to armor the sides of the drainage channel (Figure 6).

Figure 5 - Permanently 'Closed' Trash Fence Design

Figure 6 - Trash Fence With Hinged Gate



2.3.1 Site Specific Description

As previously stated, Table 1 provides a summary of the six selected storm drain outfall sites and their associated road and parking lots survey areas and land uses. It should be noted that drainage areas ranged from 2.3 to 226 acres. Land uses included low-density residential (large lot, ~ 1 acre single family), medium-density residential (small lot, 1/8 acre single family and townhouses), high-density residential (garden apartments), commercial and industrial. Additional site descriptions are as follows.

Baughman Drive (NWB-SD1) - Low Density, Single Family Residential

Figure 7 - Installing the Baughman Drive Fence

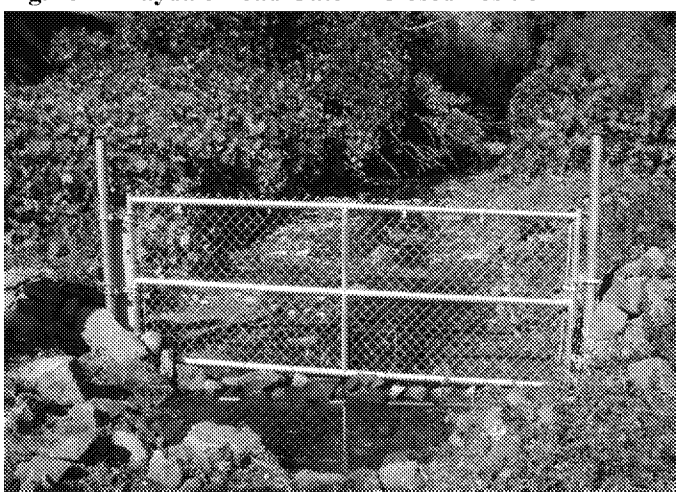
The Baughman Drive trash fence is located within the Upper Northwest Branch subwatershed in Montgomery County. It drains a low density residential community made up of large lot single family homes. The drainage area is approximately 6.9 acres, of which 0.5 acres of roadway area drains to the storm drain outfall. The storm drain system features five storm drain inlets and a 24-inch diameter reinforced concrete pipe (RCP) outfall, which discharges into an earthen drainage channel. The trash fence is located 20 feet downstream of this outfall adjacent to the Buckhorn Branch tributary of the Northwest Branch.

The design of the trash fence incorporated two 4-inch by 4-inch, six foot long supporting posts augured (approximately 24-30 inches deep) into the sides of the channel. A six foot by three foot aluminum tube frame gate panel with 2-inch openings was inserted between the slotted posts, flush against the bottom of the channel (Figure 7). This design allowed the panel to be removed when not in use.

Raydale Road (SC-SD2) - Medium Density, Single Family Residential

The Raydale Road trash fence is located within the Sligo Creek subwatershed in Prince George's County. The fence is located on M-NCPPC Park Lawn Community Park property, but drains mainly medium density single family homes (Chillum-Ray community). It should be noted that there is a small amount of commercial and institutional land uses present along Riggs and Ray Roads, respectively. The drainage area totals approximately 65 acres, of which approximately 12 acres are associated with road and parking lots areas. It also features approximately 30 storm drain inlets and a 48" RCP outfall. The trash fence is located approximately 35 feet downstream of the outfall and approximately 80 feet upstream of the Sligo Creek mainstem.

Figure 8 - Raydale Road Gate in Closed Position



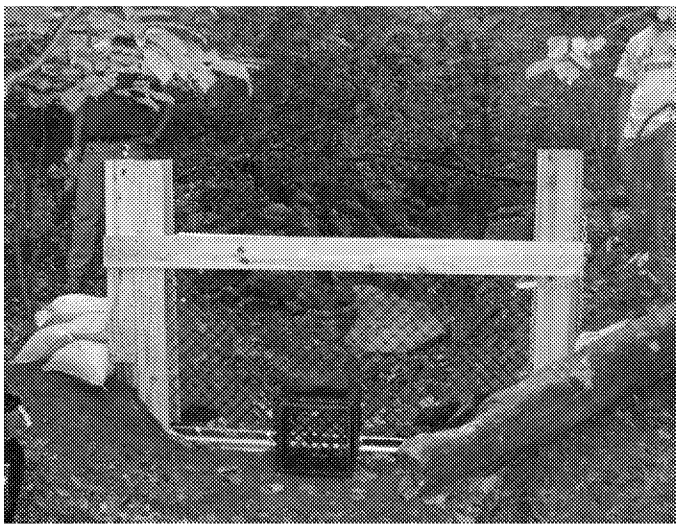
A custom fabricated, heavy duty swinging steel gate was employed at this site (Figure 8). The single, hinged gate panel was attached to heavy gauge steel posts located along the bottom edge of the channel. Large boulder-sized stones were employed along the bottom and sides of the trash fence to fill the voids spaces and to armor the sides of the drainage channel.

Silver Spruce Townhouses (LPB-SD1) - Medium Density, Residential Townhouses

The Silver Spruce trash fence is located within the Little Paint Branch subwatershed in Montgomery County. The fence is located on M-NCPPC park property directly behind the Silver Spruce Circle Town Homes development. The site drains an area comprised of medium density town houses and associated parking lots. The drainage area is approximately 2.3 acres, of which approximately 0.7 acres are parking lots and roadway areas. The site has one storm drain inlet and a 21-inch RCP outfall, which discharges into a small earthen channel. The trash fence is located approximately 30 feet downslope of the outfall (Figure 9).

The trash fence design employed at this site was the removable trash fence panel. It featured two, four-inch by four-inch slotted support posts augured into the sides of the outfall channel. A six foot by three foot aluminum chain link fence panel was inserted in between the posts, flush with the bottom of the channel. Down slope of the trash fence, stormwater flows (through an open gully/ channel) for approximately 100 feet before entering the Silverwood Tributary, a feeder stream to the Little Paint Branch.

Figure 9 - Silver Spruce Trash Fence



Kirkwood Apartments (NWB-SD2) - High Density, Residential Garden Apartments

The Kirkwood Apartments trash fence is located within the Northwest Branch subwatershed in Prince George's County. The fence is located on M-NCPPC park property, but drains an adjacent area made up of high density garden apartments (Kirkwood Apartments). The drainage area totals approximately three acres, of which approximately one acre is associated with road and parking lots. The site has five storm drain inlets and a 24 inch RCP outfall which discharges into an earthen drainage ditch. The trash fence is located approximately 30 feet downslope of the outfall.

The design of this trash fence differs somewhat from all others in that the fence is left in a permanent 'closed' position. It consists of two-inch diameter opening chain link fence placed across the full width of the channel and supported by four steel posts (Figure 10). The chain link fence was buried approximately six inches below the invert of the channel, so as to reduce the likelihood of piping. Downstream of the fence is an approximately 50-foot long earthen channel that flows into the Northwest Branch.

Figure 10 - Kirkwood Apartments Trash Fence and Kudzu

Kemp Mill Shopping Center (SC-SDR1) - Commercial

The Kemp Mill Shopping Center trash fence (SC-SD1) is located within the Sligo Creek subwatershed in Montgomery County. The fence is located on M-NCPPC's Sligo Creek Park property (Figure 11), but drains a commercial area (mainly consisting of a parking lot for the Kemp Mill Shopping Center). The drainage area totals approximately 4.2 acres, of which 3.3 acres are parking lot and roadway areas. The site has one storm drain inlet and a 27-inch RCP outfall, which discharges into an earthen and rock-lined channel.

Figure 11 - Installing the Kemp Mill Fence

The trash fence design employed at this site was the removable trash fence panel. It featured two, four-inch by four-inch slotted support posts augured into the sides of the outfall channel. A six foot by three foot aluminum chain link fence panel was inserted in between the posts, flush with the bottom of the channel. Downslope of the fence is an approximately 400-foot long drainage channel that discharges into Sligo Creek.

Beltsville Industrial Park (IC-SDR1) - Industrial

The Beltsville Industrial Park trash fence (IC-SD1) is located within the Indian Creek subwatershed in Prince George's County. The fence sits on USDA-BARC property adjacent to the CSX Capitol subdivision railroad tracks. It drains an area of predominantly industrial and commercial land uses (i.e., the Beltsville Industrial Park). The associated drainage area is approximately 226 acres, of which approximately 66.5 acres are roads and parking lots. The site has approximately 68 storm drain inlets and a drainage network that terminates into an unnamed intermittent tributary of Indian Creek via a 48-inch box culvert. The trash fence was located 25 feet downstream of the culvert.

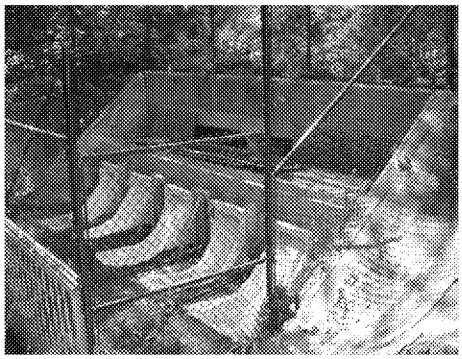
The trash fence design employed at this site consisted of two custom fabricated, heavy duty steel gates (Figure 12). The hinged gate panels were attached to heavy gauge steel posts located along the bottom edge of the channel. Sandbags were employed along the bottom and sides of the trash fence to both fill voids spaces and to armor the sides of the drainage channel. When in use, the gates are swung across the channel and locked with a chain and padlock in the center. Indian Creek is located approximately 650 feet downstream of the trash fence.

Figure 12 - Beltsville Industrial Park Trash Fence

2.4 Fresh Creek Netting Trashtrap® Systems Monitoring (Task 5)

The design and installation for both the Ray Road and Flagstaff Street systems was completed by Fresh Creek Technologies. These Trashtrap systems are maintained by the Prince George's County Department of Environmental Resources (PGDER) and their subcontractors. The trash nets are made of nylon material with 0.5 inch diameter openings. They are removed using a boom truck by a qualified contractor on an as needed basis. Once removed, the trash net contents are then separated by their respective trash and organic material contents. Trash items are sorted, weighed and catalogued according to the 20 trash categories. Similarly, organic material is weighed. Once the monitoring has been completed the contractor removes the trash, nets and organic material for disposal at a nearby landfill. Nets are replaced after each servicing. Additional information regarding the Fresh Creek Netting Trashtrap® systems monitoring protocol in included in Appendix 1.

Figure 13 - Takoma Branch Fresh Creek Netting Trashtrap® System, Fall 2007



The Takoma Branch Trashtrap (SC-TN) is located within the Sligo Creek subwatershed in Prince George's County. The Trashtrap is located immediately downstream of Ray Road near the Ray Road and Knollbrook Drive intersection. This Trashtrap consists of five removable 0.5 inch diameter opening nylon fabric mesh bags that are attached to a ridged metal face plate. The entire system is surrounded by a chain link fence designed to prevent vandalism and/or injury.

The upstream drainage area is approximately 659 acres. It is primarily made up of medium density single family residential and garden apartment buildings, as well as some commercial land use areas. The medium density, single family residential land use areas are located within all three jurisdictional portions of the catchment (i.e., Prince George's County, the District of Columbia and Montgomery County). The netting system installation was completed in October 2007 (Figure 13). As of the first week of June 2009, the system was taken off-line because of structural failure resulting from a week of high stormflows.

The Lower Beaverdam Creek Trashtrap (LBC-TN) is located within the Lower Beaverdam Creek watershed in Prince George's County. The trash trap is physically located in M-NCPPC's Kentlands Park near the intersection of Flagstaff Street and Columbia Place. It consists of a set of four removable 0.5 inch diameter opening fabric mesh nets that are attached to a ridged metal face plate (Figure 14). The entire system is also surrounded by a chain link fence designed to prevent vandalism and/or injury.

The netting system serves a 40.8 acre drainage area that is primarily made up of high density residential garden apartments and medium density residential single family homes. It should be noted that the Kent Village Garden Apartment employs storm drain inlet grates for the majority of their inlets (Figure 15).

Figure 14 - Lower Beaverdam Creek Fresh Creek Netting Trashtrap® System, Spring 2009

Figure 15 - Lower Beaverdam Creek- Kent Village Apartment Storm Drain Inlet Grate

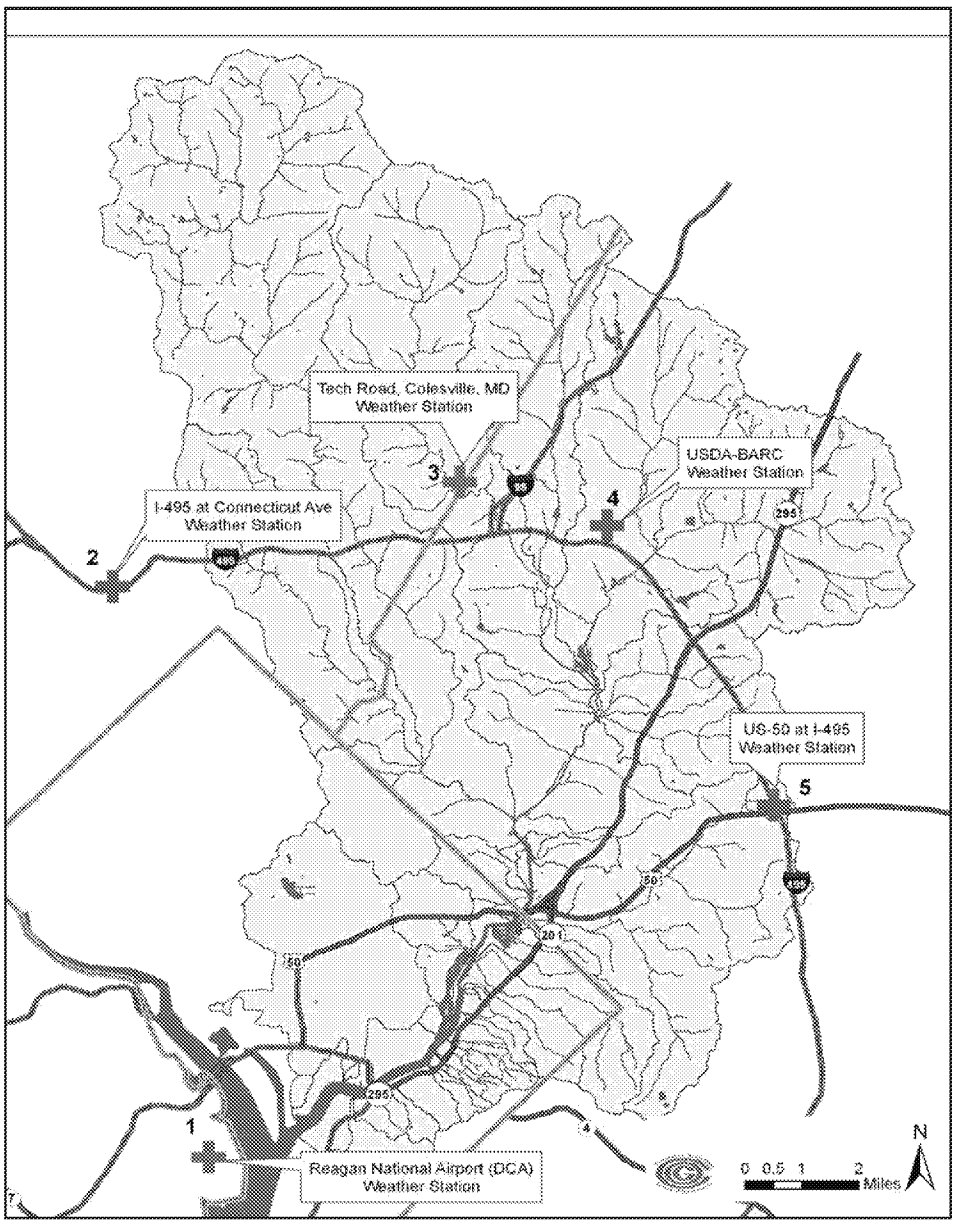
2.5 Precipitation Data

As part of this study, COG staff collected rainfall data from five weather stations located either within the Anacostia watershed or within close proximity. Three of these stations are located within the Anacostia watershed. Rainfall-related data, such as total precipitation and intensity, was obtained from these stations.

Figure 16 shows the general location of the five weather stations. There are two weather stations (1 and 2) located west (just outside of the Anacostia watershed). Station 1 is operated by The National Oceanic and Atmospheric Agency (NOAA) and is located at Reagan National Airport (DCA) in Arlington, Virginia. Precipitation records, from the DCA station, date back to 1871. Weather station number 2 is located near Interstate 495 and Connecticut Avenue (Bethesda, MD) and is maintained by the Maryland State Highway Administration (SHA).

Within the Anacostia watershed, there are three weather stations. The most northerly station of these is station 3, located on Tech Road at the Washington Suburban Sanitary Commission (WSSC) facility in Montgomery County, Maryland. It is operated by MCDEP. Heading east are stations 4 and 5. Station 4, is located on the 'North' Farm of the Henry A. Wallace Beltsville Agricultural Research Center (BARC) in Prince George's County. This station is operated by BARC staff. Station 5, the furthest easterly located station, is near the intersection of US-50 and Interstate 95 in Prince George's County. All five stations report rainfall data at hourly intervals, with stations 3 (Tech Road) and 4 (BARC) reporting 15-minute data resolution. Notably, these five stations provided generally consistent continuous precipitation data within the 2008-2009 study period, with stations 1 (DCA), 3 (Tech Road) and 4 (BARC) providing the most complete set of data.

Figure 16 - Washington Metropolitan Area Selected Weather Station Locations



3.0 Results

3.1 Rainfall Data Summary

Where possible, COG staff obtained monthly precipitation data (i.e., from May 2008 to July 2009) from weather stations located either within the Anacostia watershed or within close proximity. The three principal stations used during the study were the USDA's BARC North Farm, WSSC's Tech Road and DCA. Figure 17 shows the total monthly rainfall from May 2008 through July 2009. In addition, the mean DCA's 30 year period (i.e., 1971 - 2000) monthly rainfall total is depicted. In general, there were four months that all the stations reported higher than mean monthly rainfall totals, May 2008, and April, May, and June 2009. There were seven months that the rainfall was below the mean; August, October and November 2008; and January, February, March, and July 2009. For the months of June, July, September and December 2008, the monthly rainfall was near the normal with at least one station reporting significantly higher totals than the mean. Figure 17 also highlights the spatial variation in precipitation across the stations. Notably, the September, 2008 shows DCA with much higher rainfall totals as a result of the more southerly track of the Tropical Storm Hanna. In addition, in May 2009 DCA received over eight inches of rain while the BARC site received only five inches. Even for stations that are only three miles apart, though to a lesser degree, in May 2009 the Tech Road station 3 rainfall total was 0.73 inches more than at BARC station 4. However, in June 2009, the reported rainfall total from the BARC station was 0.75 inches more than for the Tech Road station. Appendix 3 is included for additional rainfall-related data.

Figure 17 - Monthly Rainfall Data Summary - May 2008 - July 2009

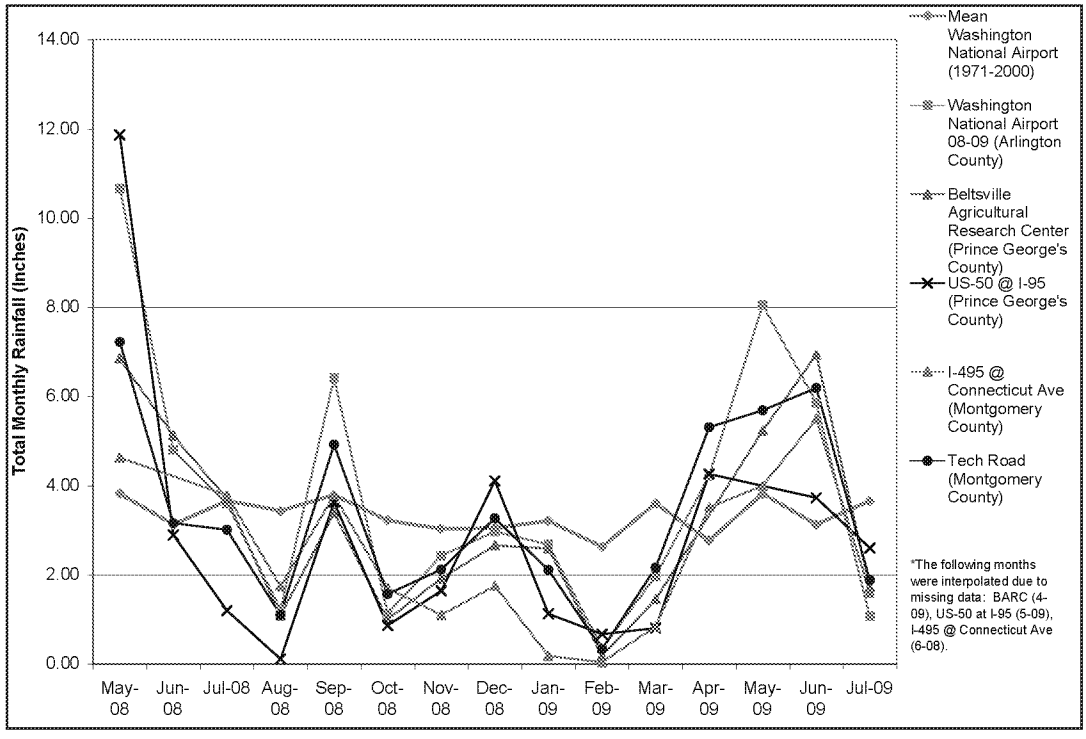


Table 2 illustrates the spatial precipitation variations from station to station in June 2009. Daily total precipitation was reported at the following stations: DCA (station 1), Tech Road (station 3), BARC (station 4) and MDSHA US 50/I-495 (station 5). The daily rainfall total ranged from 0.01 to 1.79 inches. The daily maximum rainfall intensity ranged from 0.01 to 2.16 inches per hour (Note: that for stations 3-4, rainfall intensities were reported in 15-minute intervals). As previously stated, reported rainfall totals and intensities were highly variable from station to station within and near the Anacostia watershed. For example, the June 3, 2009 rainfall total was reported as 1.50, 1.05, 1.18 and 0.80 inches for stations 1 (DCA), station 3 (Tech Road), station 4 (BARC) and station 5 (US 50/I-495), respectively. Furthermore, the reported maximum intensities were reported as 0.66, 0.64, 2.16 and 1.33 inches per hour for stations 1 (DCA), station 3 (Tech Road), station 4 (BARC) and station 5 (US 50/I-495), respectively. With varying rainfall data reported (spatial and temporal precipitation differences) in both within and near the Anacostia watershed, relating trash generation data from specific land use areas requires the installation of site specific weather stations.

Table 2 - June 2009 Rainfall Event Summary

Date	Station 1 DCA		Station 3 Tech Road		Station 4 BARC		Station 5 US 50/I-495	
	Total Rainfall (inches)	Maximum Intensity (in/hr)	Total Rainfall (inches)	Maximum Intensity (in/hr)	Total Rainfall (inches)	Maximum Intensity (in/hr)	Total Rainfall (inches)	Maximum Intensity (in/hr)
6/3/2009	1.50	0.66	1.05	0.64	1.18	2.16	0.80	1.33
6/4/2009	0.52	0.13	0.82	0.20	0.40	0.24	0.62	0.34
6/5/2009	0.57	0.07	0.66	0.12	0.47	0.08	0.71	0.23
6/9/2009	0.89	0.54	0.72	1.72	0.62	1.04	0.08	0.11
6/10/2009	0.48	0.24	0.54	0.84	1.79	2.40	0.37	0.68
6/11/2009	0.00	0.00	0.16	0.04	0.00	0.00	0.00	0.00
6/12/2009	0.02	0.01	0.04	0.04	0.03	0.04	0.00	0.00
6/13/2009	0.00	0.00	0.02	0.04	0.22	0.72	0.00	0.00
6/14/2009	0.00	0.00	0.04	0.04	0.00	0.00	0.00	0.00
6/15/2009	0.00	0.00	0.02	0.04	0.00	0.00	0.00	0.00
6/17/2009	0.08	0.04	0.05	0.04	0.03	0.04	0.00	0.00
6/18/2009	1.01	0.80	0.99	0.52	1.11	0.60	0.82	0.57
6/20/2009	0.39	0.23	0.50	1.00	0.46	0.88	0.00	0.00
6/21/2009	0.00	0.00	0.04	0.08	0.01	0.04	0.00	0.00
6/24/2009	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00
6/26/2009	0.00	0.00	0.06	0.20	0.02	0.08	0.00	0.00
6/30/2009	0.02	0.02	0.48	0.60	0.59	1.08	0.00	0.00
Total	5.48	--	6.19	--	6.94	--	3.4	--

3.2 Stream Survey Summary

As previously indicated, the Anacostia trash TMDL-related baseline conditions surveys were conducted within a 500-foot long stream channel section for 15 Montgomery County and 15 in Prince George's County randomly selected sites. Sampling was performed for the four following seasonal periods: Spring 2008; Summer 2008; Winter 2008-09; and Spring 2009. In addition, trash items were counted and categorized into the 20 MDE generic categories. It should be noted that the during both high leaf fall (October - December 2008) and periods of poor water clarity, the surveys were not conducted as both of these in-stream conditions obscured the enumeration of trash items.

As reported in the ICPRB survey (Appendix 2) "a total of 35,913 pieces of trash were counted for the entire survey." Total trash items (Figure 18) was highest, at 10,699 items, in the spring 2008 sample, and lowest in the spring 2009 (8,162 items).

The six most common types of trash (e.g., plastic bags, food packaging, etc.) totalled 28,503 pieces, or 79.4 percent of the total. Figure 19 illustrates these top six trash items as percent total composition. The six most common types of trash in descending order of frequency were plastic bags, food packaging, construction debris (e.g., bricks, concrete, wood), Styrofoam, plastic bottles, and aluminum cans. Their respective percent of the total are 33.3 percent, 11.5 percent, 9.7 percent, 9.1 percent, 8.6 percent, and 7.1 percent. The remaining 14 trash items are grouped into 'other' category and their total represents 20.7 percent of the total trash items counted.

Importantly, four floatable trash items (i.e., plastic bags, food packaging, Styrofoam and plastic bottles) account for over 62 percent of the total trash items counted. They are shown, for each survey sampling season in Figure 20. With the exception of food packaging, plastic bags, Styrofoam, and plastic bottles were highest in the spring 2008 sample. Food packaging was highest in the summer 2008 sample.

Figure 18 - Stream Summary - Trash Items Counted and Percent of Total

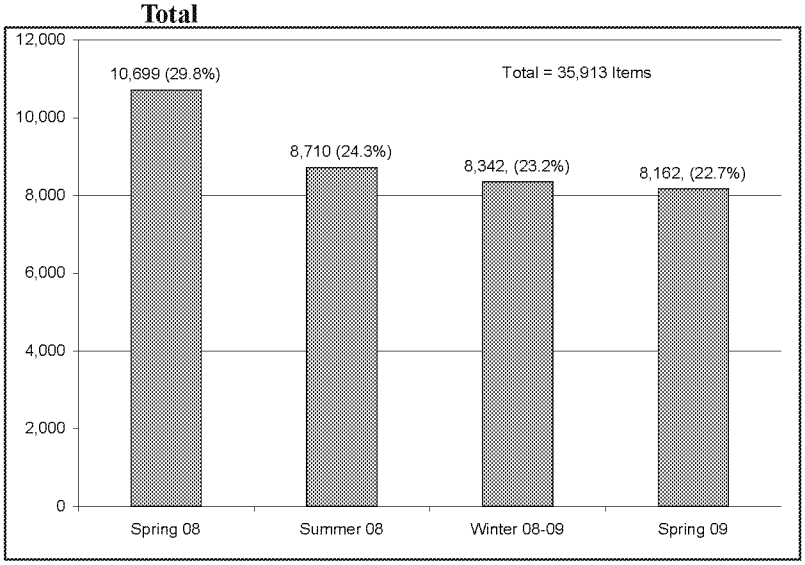


Figure 19 - Stream Summary - Top Six Trash Items Percent of Total

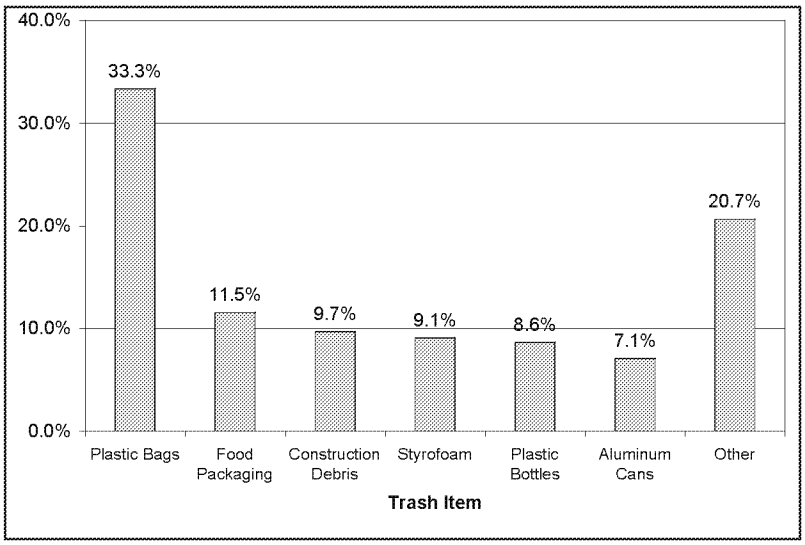
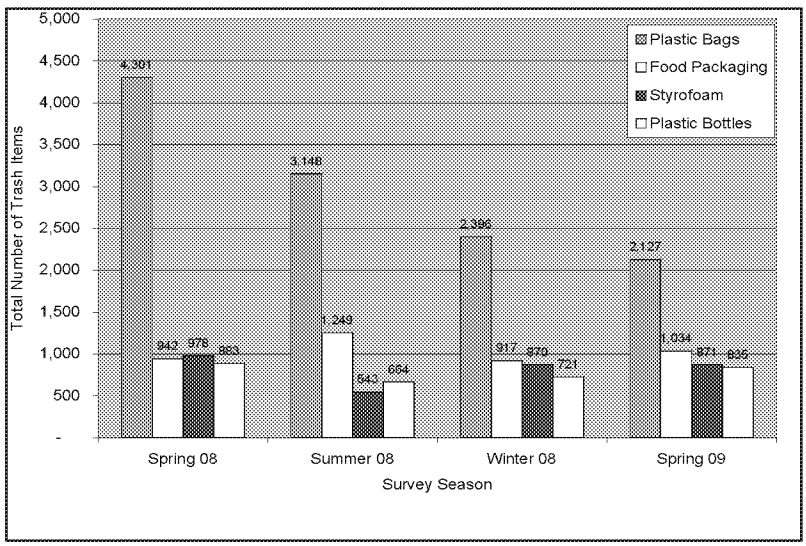


Figure 20 - Selected Floatable Trash Items Per Sampling Season



For the eight subwatersheds surveyed, the highest mean number of trash items per 100 feet was observed in Lower Beaverdam Creek (159.9), followed by Watts Branch (108.3), Indian Creek (71.9), Northeast Branch (62.7), Sligo Creek (57.6), Paint Branch (43.8), Northwest Branch (30.3) and Little Paint Branch (14.1) (Figure 21). Table 3 represents the 1998 Anacostia Trash Reduction Workgroup's (ATRW) stream trash survey index, which provides a verbal ranking for the number of trash items per hundred feet range. It should be noted that this index has been in continuous use since 1998. Excluding the Little Paint Branch (which fell into the 'light' category) and both Northwest Branch and Paint Branch (which fell into the 'moderate' category), all the other remaining subwatersheds fell into the 'high' category.

Figure 21 - Stream Subwatershed Summary - Mean Number of Items per 100 Feet

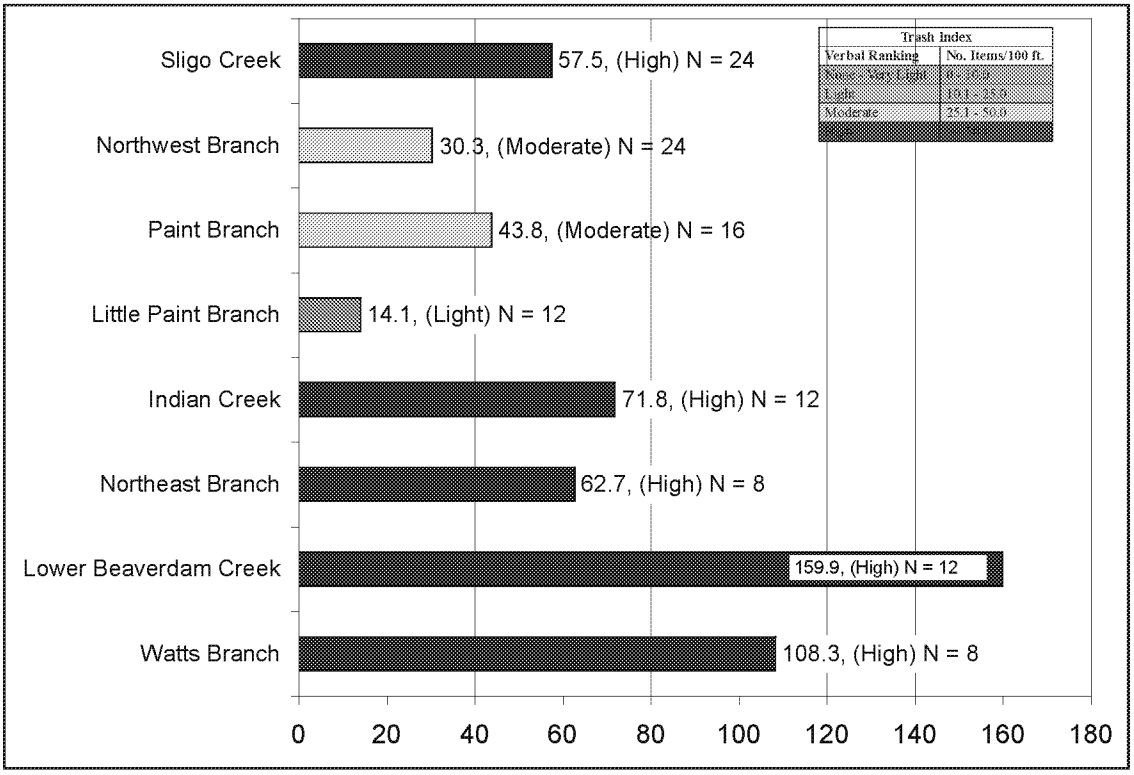


Table 4 and Figure 22 show the mean number of items per 100 feet over four survey dates for both Montgomery and Prince George's counties. Overall, there were 12 sites with 'high', seven 'moderate', six 'light' and five 'none' - 'very light' rankings. Per jurisdiction, the Montgomery County sites totaled 6,693 trash items or 18.6 percent of the total trash items counted. In contrast, Prince George's County streams sites totaled 29,220 items or approximately 81.4 percent of the total. The mean number of items per 100 feet for Montgomery County was 22.3, placing it in the 'light' category and the mean number of items per 100 feet ranged from 3.1 - 64.7. For Prince George's County, the mean number of items per 100 feet was 97.4, placing it in the 'high' category and ranged from 9.5 - 264.25 mean number of items per 100 feet. Figure 22 shows by jurisdiction and site location mean number of items per 100 feet. The number of Montgomery County sites with 'high', 'moderate', 'light' and 'very light' trash index categories were 1, 4, 6 and 5, respectively. For Prince George's County, the number of sites with 'high', 'moderate', 'light' and 'very light' categories were 11, 3, 0 and 1, respectively. It should be noted that the one 'very light' ranking is located in the Capital Heights tributary to Watts Branch. The surveyed stream section is a concrete-lined channel section which effectively conveys trash downstream (Figure 23).

Table 3 - Anacostia Trash Reduction Workgroup's Stream Trash Survey Index

Trash Index	
Verbal Ranking	**No. Items/100 ft.**
None - Very Light	0 - 10.0
Light	10.1 - 25.0
Moderate	25.1 - 50.0
High	> 50.1

Table 4 - Summary - Stream Survey Sampling Results Per Jurisdiction

Site Name and Location	Site ID	Drain-age Area (mi^2)	Stream Order	Total Num-ber of Trash Items	Mean No. of Trash Items Per 100ft[1]	ARTW Trash Rank-ing[2]	Top Six Trash Items[3]	
							Top 3 Items	Next 3 Items
Montgomery County								
Sligo Creek (Long Branch)	SCLB101	0.99	1	462	23.1	Light	1,13,9	4,5,6
Sligo Creek (University Blvd)	SCSC204	0.99	2	311	15.6	Light	1,9,5	2,13,20
Sligo Creek (Forest Glen Road)	SCSC301	2.87	2	188	9.4	V. Light	1,9,5	2,13,20
Sligo Creek (Carroll Ave)	SCSC314	7.17	2	906	45.3	Moderate	13,9,4,	20,19,16
Northwest Branch (Batchellors Run)	NWBF301	2.78	2	634	31.7	Moderate	13,16,1	8,20,3
Northwest Branch (Bryants Nursery Tributary)	NWNW206A	1.35	2	62	3.1	V. Light	13,16,1	20,3,4
Northwest Branch (Layhill Park)	NWNW402	12.09	3	168	8.4	V. Light	13,1,19	2,9,3
Northwest Branch (Bel Pre Creek)	NWBP205	3.74	2	730	36.5	Moderate	1,2,5	9,20,19
Northwest Branch (Kemp Mill Rd)	NWNW407D	21.19	3	607	30.4	Moderate	1,2,9	4,5,20
Paint Branch (Valley Mill Park)	PBPB308	9.23	3	204	10.2	Light	1,2,5	9,20,8
Paint Branch (Hollywood Branch)	PBHB210	1.59	2	1,294	64.7	Moderate	1,2,5	9,4,19
Little Paint Branch (Fairland Pk North)	LPLP109	0.45	1	331	16.6	Light	1,5,2	9,8,4
Little Paint Branch (Fairland Pk Central)	LPLP301A	2.22	2	306	15.3	Light	5,1,2	9,4,11
Little Paint Branch (S of Greencastle Rd)	LPLP205	1.49	2	348	17.4	Light	1,5,2	9,8,16
Little Paint Branch (Briggs Chaney Rd)	LPLP202	0.92	2	142	7.1	V. Light	1,9,5	5,19,8
Prince George's County								
Sligo Creek (Takoma Branch)	SCTB02A	1.17	3	3,143	145.9	Light	1,19,9	4,16,20
Sligo Creek (Park Lawn Park)	SC001	10.43	2	1,892	94.6	High	1,5,9	3,2,20
Northwest Branch (Hyattsville Metro)	NWB006	48.50	4	1,437	71.9	High	1,9,2	5,4,8
Paint Branch (Univ Blvd)	PB004	18.23	4	703	35.2	Moderate	1,9,2	4,19,16
Paint Branch (Rt 1)	PB001	30.14	4	1,305	65.3	High	4,1,9	2,5,6
Indian Creek (Ammendale Rd)	IC033	4.02	2	562	28.1	Moderate	1,5,9	4,2,20
Indian Creek (Beaverdam Road)	IC038	8.96	2	3,127	156.4	High	1,5,9	3,2,20
Indian Creek (Greenbelt Metro)	IC008B	26.96	4	618	30.9	Moderate	1,4,9	5,3,20
Northeast Branch (Riverdale Park)	NEB006	69.79	5	1,393	69.7	High	1,9,5	2,4,8
Northeast Branch (Rt 1 Alt)	NEB004	75.07	5	1,116	55.8	High	1,2,9	4,5,20
Lower Beaverdam Creek (Cabin Branch)	LBCCNB020A	1.03	1	1,189	59.5	High	1,9,2	5,20,3
Lower Beaverdam Creek (New Carrollton Metro)	LBC040A	1.70	2	3,117	155.9	High	1,9,5	2,4,8
Lower Beaverdam Creek (Rt 50)	LBC003	14.83	4	5,285	264.3	High	1,16,13	8,20,9
Watts Branch (Bugler St)	WB003	0.79	2	4,142	207.1	High	1,3,9	2,4,5
Watts Branch (Faye Street)	WB004	0.74	1	191	9.6	V. Light	9,1,2	16,20,5

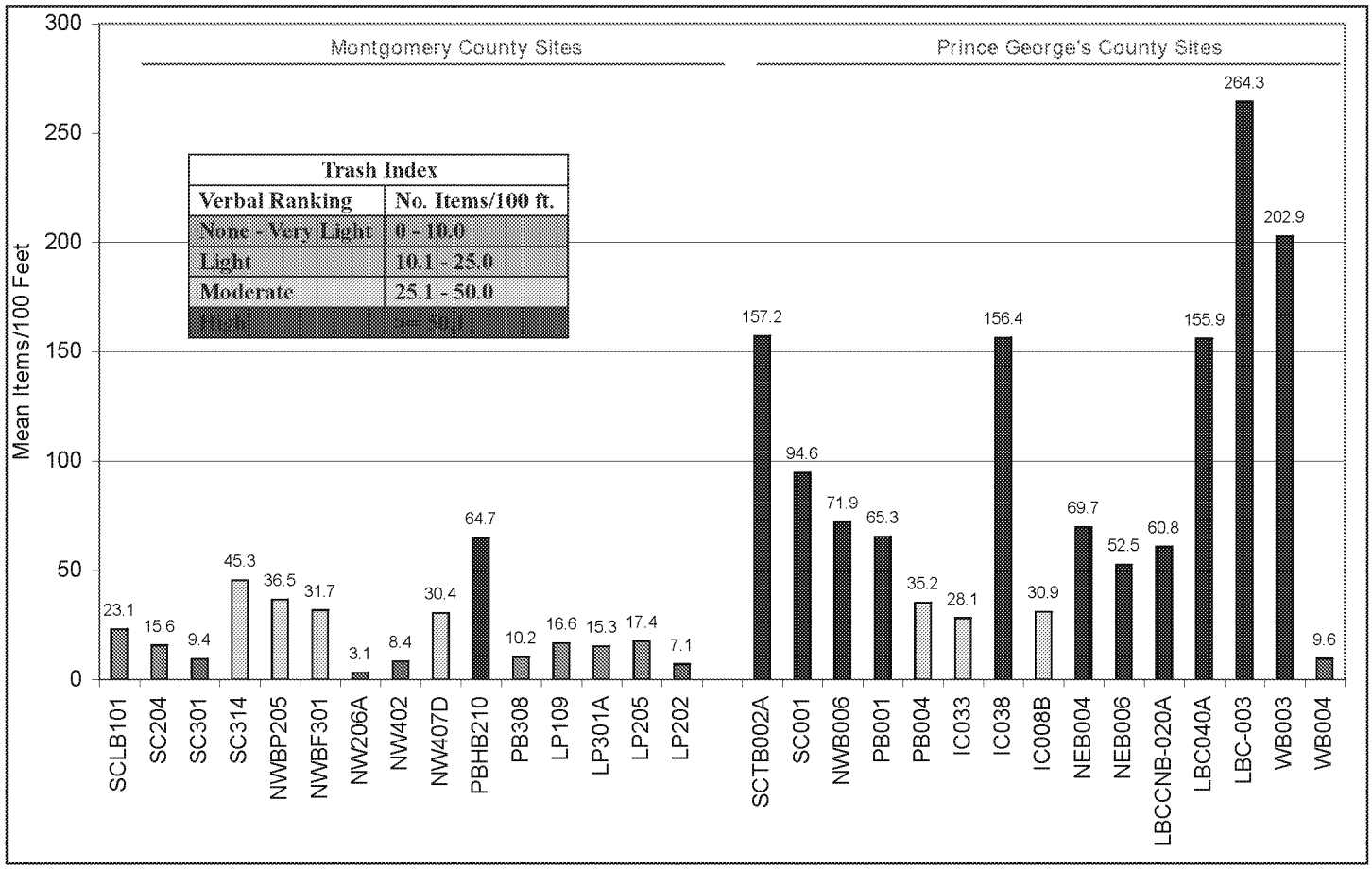
[1] Mean of four survey seasons: N = 4

[2] 1998 ATRW Trash Index - Verbal Ranking = No. Items/100 ft: None - Very Light = 0 - 10.0; Light = 10.1 - 25.0; Moderate = 25.1 - 50.0; and High = >= 50.1

[3] Trash Item Categories:

1) Plastic Bags 2) Plastic Bottles; 3) Glass Bottles; 4) Aluminum Cans; 5) Styrofoam (cups, packaging etc.); 6) Paper (newspaper, magazines, etc.); 7) Cardboard; 8) Cloth/Clothing/Carpeting; 9) Food Packaging; 10) Auto (a) Oil Quart Containers; b) Oil Filters Antifreeze; c) Containers d) Body Parts Large >1ft^2; and e) Body Parts Small <1ft^2); 11) Car Batteries; 12) Tires (Cars, Truck); 13) Construction Debris: (a) Bricks (>1/2 brick); b) Concrete; c) Lumber; and d) Misc. (e.g. dry wall, etc)); 14. Appliances; 15) Wooden Pallets; 16) Metal (Drums, Cans, Pipes, etc.); 17) Shopping Carts; 18) Toiletries/Drug Containers; 19) Sports Equipment/Toys; and 20) Miscellaneous.

Figure 22- Stream Summary - Mean Number of Items per 100 Feet by Jurisdiction



Included as part of the stream survey, trash 'strainers' (i.e., natural or anthropogenic features such as log/debris dams, large protruding tree roots and rootwads, gabion baskets, large appliances, shopping carts, etc.) were also counted. Strainers effectively capture and temporarily retain trash, particularly floatables (Figure 24). During this four survey periods, a total of 873 strainers were observed at the 30 sites, with a mean of approximately 218 strainers per season.

Figure 23 - Capitol Heights Tributary To Watts Branch

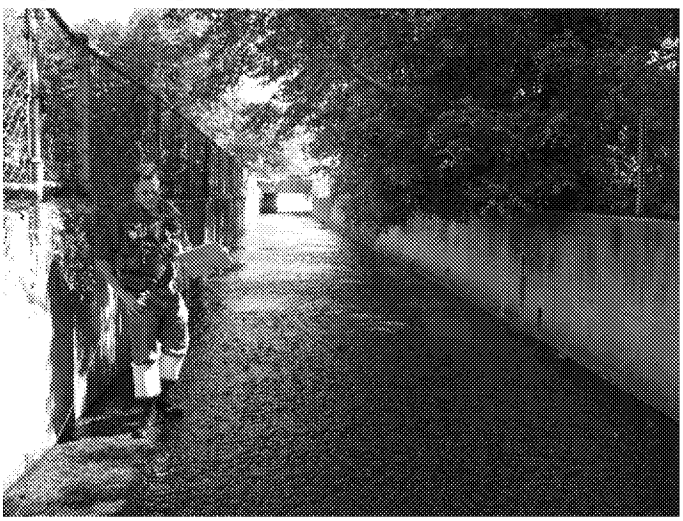


Figure 24 - Trash Strainer - Tree Fall Across The Stream

In addition, the following exploratory regression analyses were performed:

1. Total number of upstream storm drain outfalls ($R^2 = 0.0176$);
2. Approximate stream channel distance (stream survey site) from its headwater ($R^2 = 0.016$);
3. Upstream drainage area ($R^2 = 0.003$);
4. Mean number of strainers ($R^2 = 0.0074$);
5. Upstream population ($R^2 = 0.0204$); and
6. Total number of upstream storm drain outfalls within approximately 700 feet of the stream channel center line ($R^2 = 0.0223$).

However, clear relationships were not observed. Figures 25-28 are selected graphs showing the mean trash items per 100 feet graphed to the number of storm drain outfalls upstream, to the distance (stream survey site) from headwaters, upstream drainage area and mean number of strainers (mean number of strainers over the four seasons surveyed).

Figure 25 - Mean Number of Trash Items per 100 Feet and Total Number of Storm Drain Outfalls Upstream

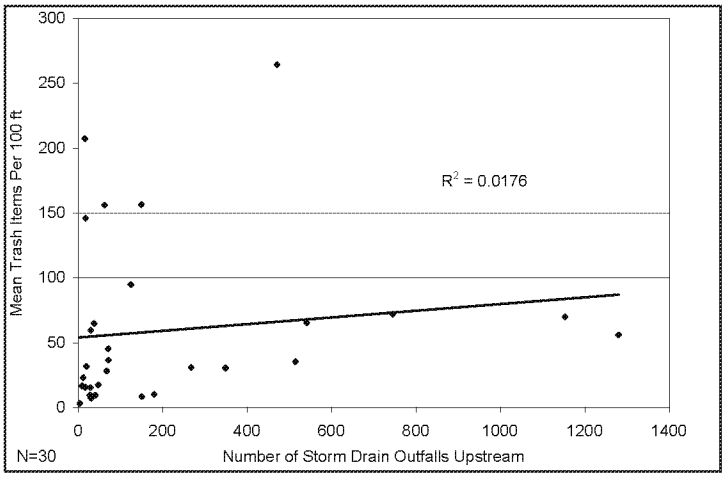


Figure 26 - Mean Number of Trash Items per 100 Feet and Distance From Headwater Area

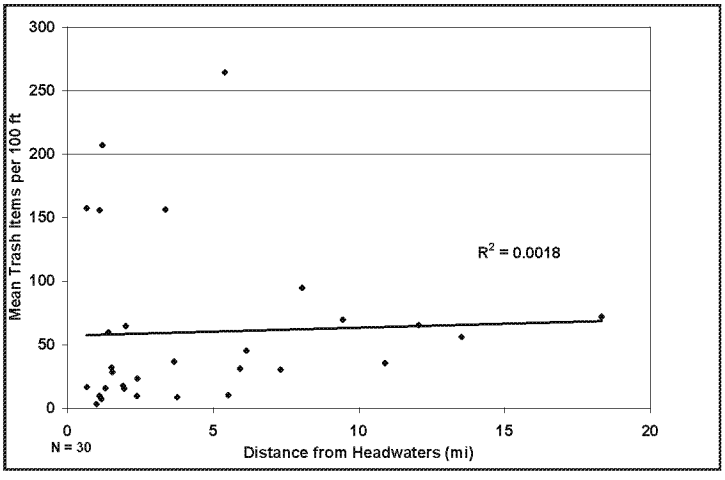


Figure 27 - Mean Number of Trash Items per 100 Feet and Upstream Drainage Area

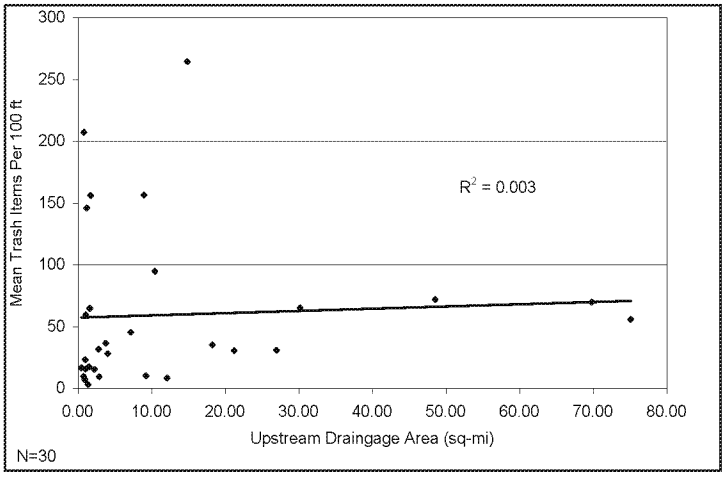
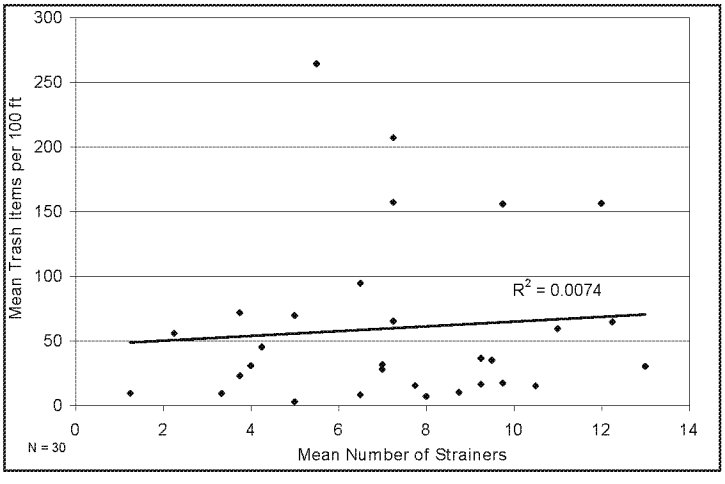


Figure 28 - Mean Number of Trash Items per 100 Feet and Mean Number of Strainers



3.2 Road and Parking Lot Monitoring Summary

As seen in Table 5, the road and parking lot surveys were conducted nine times between October 2008 and July 2009. As previously mentioned, these surveys were conducted along the road curb/gutter pan area that included five feet on either side of the curb. Both sides of the road were surveyed for a length of 300 feet. For the Kemp Mill Shopping Center parking lot, a 6,000 ft^2 area was surveyed (i.e., an equivalent area to that of the road areas surveyed). Site selections were based on homogenous Anacostia representative-type land uses. They included low density residential (large lot, ~ 1 acre single family), medium density residential (small lot, ~ 1/8 acre single family and townhouses), high density residential (garden apartments), commercial and industrial. Table 6 summarizes the general site description of the land-based/road surveys and the associated receiving storm drain outfall locations. It should be noted that the surveys were performed at least two to three days prior to a rain event, and that trash was collected, categorized, weighed and properly disposed.

Table 5 - Road and Parking Lot Survey Monitoring Period

Monitoring Task	Fall 08			Winter 08/09			Spring 09			Summer 09		
Road and Parking Lot		X	X		X	X	X	XX		X	X	
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug

As seen in Table 6, a total of 1,225 trash items were counted. The Beltsville Industrial Park and the Kemp Mill Shopping Center survey sites had the highest total counts at 497 (41 percent) and 343 (28 percent), respectively. Not surprisingly, the number of trash items per 100 feet for these industrial and commercial land use sites were also the highest at 82.3 and 57.2, respectively. Per the ATRW trash index, both industrial and commercial land use sites fell into the 'high' trash category (i.e., > 50.1 items/100 feet). For Raydale Road, (medium density, single family residential), Silver Spruce townhouses (medium density, residential townhouses) and Kirkwood Apartments (high density, residential garden apartments), the number of items per 100 feet were 22.7, 17.8

Table 6 - Summary - Road and Parking Lot Site Description, Trash Items[1] Count and Weight

Site ID	Subwatershed	Juris-diction	General Site Description	Dominant Land Use	Road/Parking Lot Survey		Items Counted					Weight			
							Total	Top 6 Categories		Mean Trash Items per 100 feet^2	Mean Trash Items per Acre	Total (lbs)	Top 6 Categories		Mean Weight per Acre
				Type	Length (ft)	Area (ft^2)		Top 3	Next 3				Top 3	Next 3	
NWB-SDR1	Northwest Branch	MC	Baughman Drive	Low-Density Residential (large lot, ~ 1 acre single family)	600	6,000	27	6, 9, 4	20, 2, 3	4.5	2.9	0.8	3, 6, 9	20, 2, 3	0.1
SC-SDR2	Sligo Creek	PG	Raydale Road	Medium Density Residential (small lot, 1/8 acre single family)			136	6, 9, 20	13, 2, 4	22.7	14.5	5.1	13, 6, 9	3, 2, 20	0.5
LPB-SDR1	Little Paint Branch	MC	Silver Spruce Townhouses	Medium Density Residential (townhouses)			107	6, 9, 20	7, 1, 2	17.8	11.4	3.7	7, 6, 20	13, 8, 3	0.4
NWB-SDR2	Northwest Branch	PG	Kirkwood Apartments	High Density Residential (garden apartments)			115	6, 20, 9	4, 1, 2	19.2	12.3	2.1	20, 7, 4	2, 6, 8	0.2
SC-SDR1	Sligo Creek	MC	Kemp Mill Shopping Center	Commercial			343	6, 9, 1	4, 5, 20	57.2	36.6	3.9	13, 9, 6	1, 20, 4	0.4
IC-SDR1	Indian Creek	PG	Beltsville Industrial Park	Industrial/Commercial			497	20, 9, 6	2, 4, 16	82.8	53.0	39.1	20, 16, 10	2, 3, 4	4.2
							1,225	6,9,20	4,2,1	34.0	21.8	54.7	20, 16, 10	13, 3, 2	1.0

[1] Trash Item Categories:
1) Plastic Bags 2) Plastic Bottles; 3) Glass Bottles; 4) Aluminum Cans; 5) Styrofoam (cups, packaging etc.); 6) Paper (newspaper, magazines, etc.); 7) Cardboard; 8) Cloth/Clothing/Carpeting; 9) Food Packaging; 10) Auto (a) Oil Quart Containers; b) Oil Filters Antifreeze; c) Containers d) Body Parts Large >1ft^2; and e) Body Parts Small <1ft^2); 11) Car Batteries; 12) Tires (Cars, Truck); 13) Construction Debris: (a) Bricks (>1/2 brick); b) Concrete; c) Lumber; and d) Misc. (e.g. dry wall, etc)); 14. Appliances; 15) Wooden Pallets; 16) Metal (Drums, Cans, Pipes, etc.); 17) Shopping Carts; 18) Toiletries/Drug Containers; 19) Sports Equipment/Toys; and 20) Miscellaneous.
[2] 1998 ATRW Trash Index - Verbal Ranking = No. of Items/100 ft: None - Very Light = 0 - 10.0; Light = 10.1 - 25.0; Moderate = 25.1 - 50.0; and High = >= 50.1

and 19.2, respectively, which put them into the 'light' trash category. As expected, the Baughman Drive site generated a survey low of 27 items, or 4.5 trash items per 100 feet (i.e., 'very light' trash level category).

The total trash weight for the six sites was 54.7 pounds. The Beltsville Industrial Park had the highest trash weight, 39.1 pounds, representing 71 percent of the total. Surprisingly, Raydale Road was, at 5.1 pounds, the second highest (approximately 9 percent). It should be noted that construction debris, comprised mainly of heavier lumber pieces, was frequently collected at Raydale Road. For the Kemp Mill Shopping Center, Silver Spruce and Kirkwood Apartments, the trash weights were 3.9, 3.7 and 2.1 pounds, respectively. The Baughman Drive site generated a survey low of 0.8 pounds of trash. Figure 29 provides a summary of the pounds per acre and number of trash items by the six different land use types.

The percent distribution of the top six items by count (Figure 30) for the roads and parking lot survey were, in descending order, paper (26.4 percent), food packaging (21.4 percent), miscellaneous (17.6 percent), aluminum cans (7.1 percent), plastic bottles (6.8 percent) and plastic bags (6.5 percent). However, the percent distribution of the top six items by weight (Figure 31) was as follows: miscellaneous (16.1 percent), metal (12.5 percent), auto parts (11.9 percent), construction debris (10.6 percent), glass bottles (9.8 percent) and plastic bottles (8.7 percent). Of the miscellaneous trash items counted (216), the Beltsville Industrial Park site (IC-SDR1) accounted for 60 percent (131 items). It also accounted for 84 percent (7.0 pounds) of the total miscellaneous trash item weight (8.3 pounds). For additional road and parking lot data, the reader is referred to Appendix 4.

Figure 29 - Summary - Trash Weight per Acre

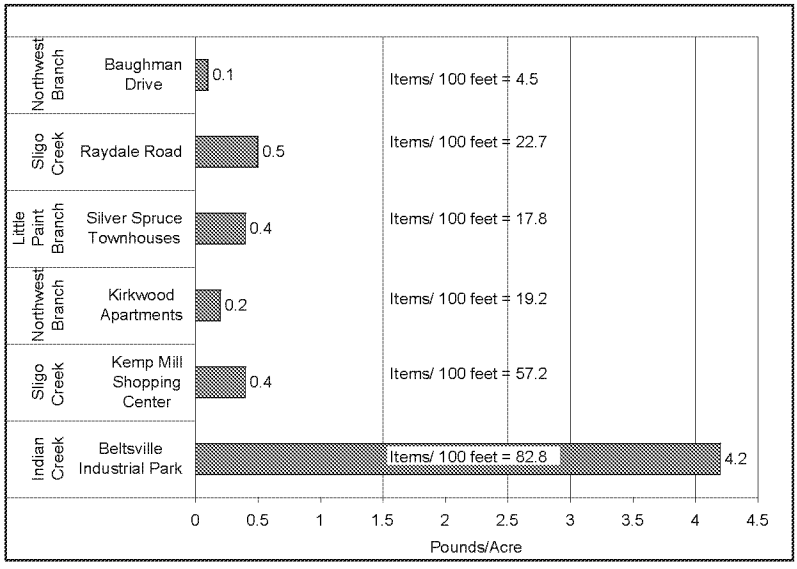


Figure 30 - Summary - Top Six Trash Items By Count

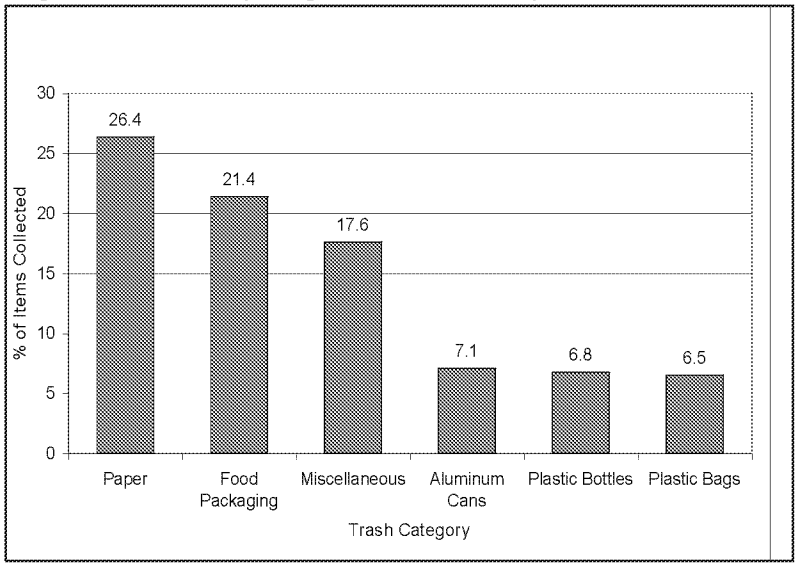
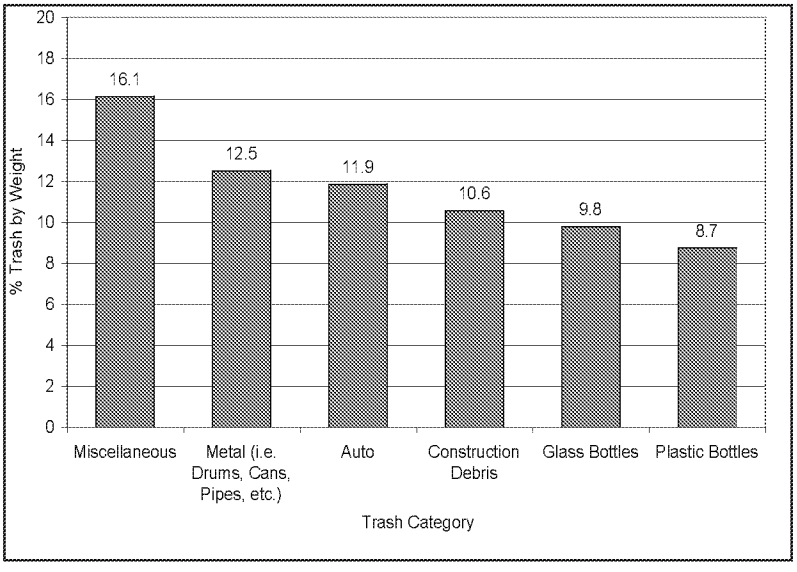


Figure 31 - Summary - Top Six Trash Items By Total Weight



3.2.1 Baughman Drive (NWB-SDR1) - Low Density, Single Family Residential

As previously mentioned, this survey site represents low density (~ 1 acre lot size) single family residential land uses in the upper Northwest Branch subwatershed in Montgomery County (Figure 32). The number of trash items counted for the survey period totaled 27, which was a survey low. The top six items were, in descending order, paper (44.4 percent), food packaging (18.9 percent), aluminum cans (11.1 percent), miscellaneous (11.1 percent), plastic (3.7 percent) and glass bottles (3.7 percent), respectively (Figure 33). Based on the ATRW trash index, trash levels were in the 'very light' range (i.e., 0 - 10.0 items).

The weight of all the trash items collected at Baughman Drive totaled 0.8 pounds, another survey low. Of the top six items by weight, glass bottles (54.7 percent) were the number one item accounting for over half of the total weight (Figure 34). In descending order, paper, food packaging, paper, plastic bags, aluminum cans, plastic bottles and Styrofoam, comprised the top six items. Their respective percent of the total weight were 14.0, 13.2, 9.3, 2.7 and 1.9.

Based on field observations, Baughman Drive is a neighborhood access road that receives light traffic. Even lighter traffic was observed on Baughman Court, a road that provides direct access to a total of three homes. During the entire survey period, the local neighborhood area, including road right-of-way areas, was always extremely well kept.

Figure 32 - Baughman Drive Road (NWB-SDR1)

Figure 33 - Baughman Drive - Top Six Trash Items By Count

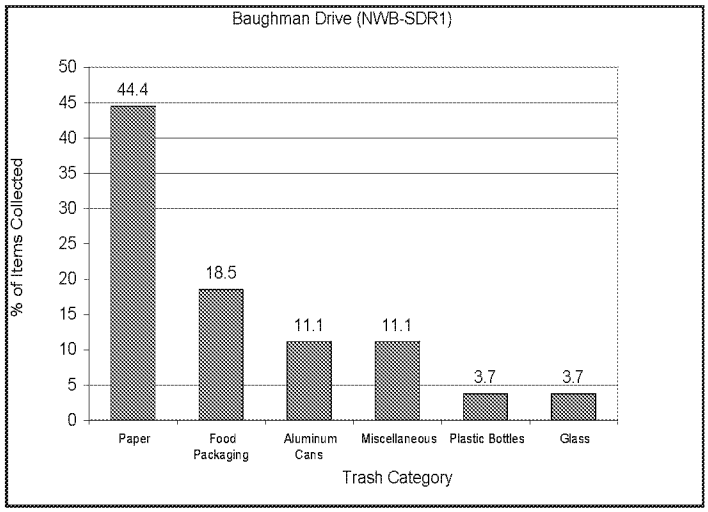
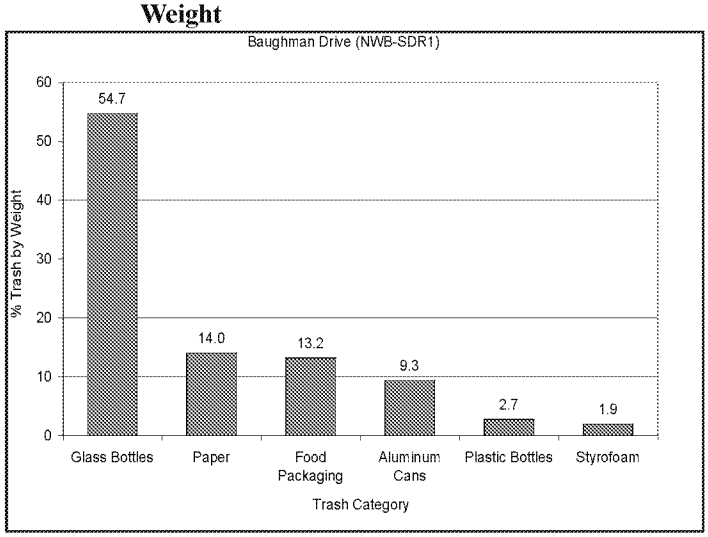


Figure 34 - Baughman Drive - Top Six Trash Items By Total Weight



3.2.2 Raydale Road (SC-SDR2)- Medium Density, Single Family Residential

This survey site represents predominantly medium density residential land uses (single family, 1/8 acre lots) in the Lower Sligo Creek subwatershed in Price George's County (Figure 35). The number of trash items counted for the survey period totaled 138. Of the top six items counted, paper (28.7 percent), food packaging (22.8 percent), and miscellaneous items (18.4 percent) were the top three items, respectively. Construction debris (11.8), plastic bottles (5.9 percent) and aluminum cans (5.1 percent) were the remaining three trash major items collected (Figure 36). Based on ATRW trash index, trash levels were in the 'light' range (i.e., 10.1 - 25.0 items).

The weight of all the trash items collected at the Raydale Road site totaled 5.1 pounds. This was the second highest weight total among all six sites. Of the top six items by weight, construction debris, at 1.97 pounds, accounted for 38.6 percent of the total weight (Figure 37). Construction debris generally included short sections of 2 by 4 inch lumber (Figure 38). Paper, food packaging, glass bottles plastic bottles and miscellaneous items, from highest to lowest, rounded out the remainder of the top six categories and their percent of the total weight was 20.4, 9.1, 8.7, 7.7 and 7.7, respectively.

Figure 35 - Raydale Road (SC-SDR2)

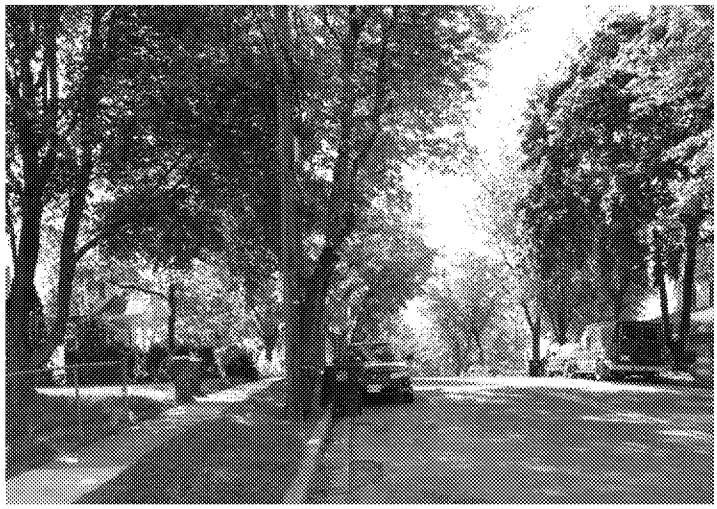


Figure 36 - Raydale Road - Top Six Trash Items By Count

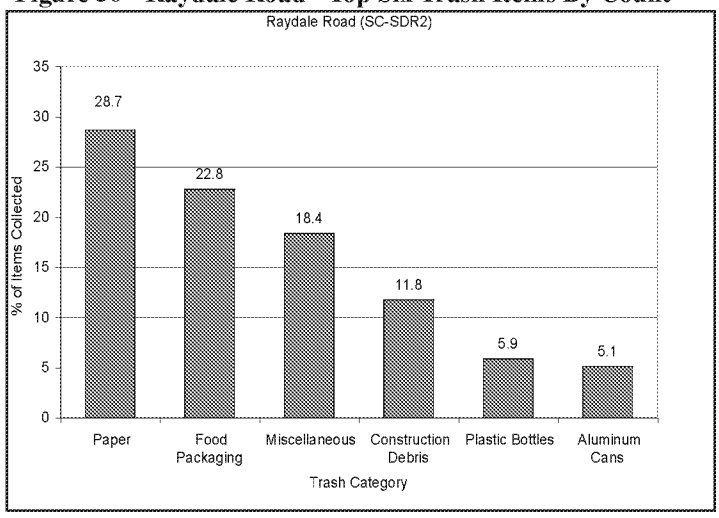


Figure 37 - Raydale Road - Top Six Trash Items By Total Weight

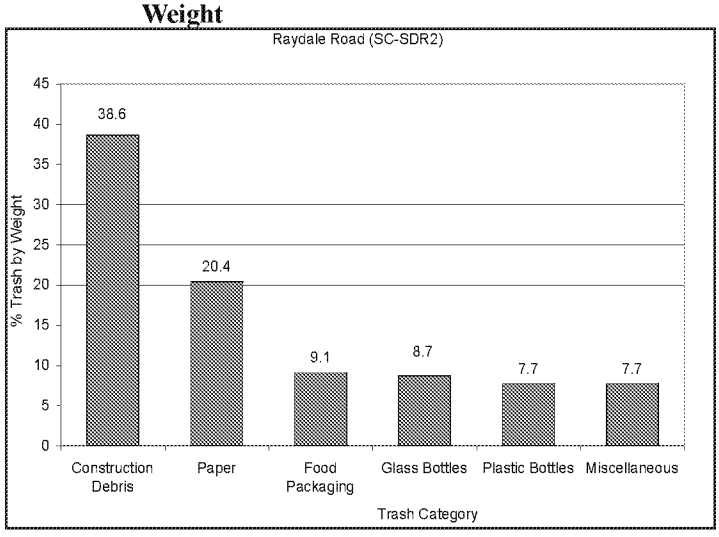


Figure 38 - Raydale Road - May 22, 2009 Survey Trash Items

3.2.3 Silver Spruce Townhouses (LPB-SDR1) Medium Density, Residential Townhouses

This survey site represents medium density, residential townhouse land uses in the Little Paint Branch subwatershed in Montgomery County (Figure 39). The number of trash items counted for the survey period totaled 107. Of the top six items counted, paper (39.3 percent), food packaging (23.4 percent), and miscellaneous items (11.1 percent) were the top three, respectively. Cardboard (4.7 percent) plastic bags (3.7 percent) and construction debris (2.8 percent) were the remaining three items of the top six trash items collected (Figure 40). Based on the ATRW trash index, trash levels were in the 'light' range (i.e., 10.1 - 25.0 items).

The weight of all the trash items collected at the Silver Spruce site totaled 3.7 pounds. Of the top six items by weight, cardboard (17 percent) was the top trash item (Figure 41). It should be noted that only five pieces of cardboard were collected during the entire survey period. One of these was an empty large-size pizza container. Paper, miscellaneous, construction debris, cloth/clothing/carpeting, and glass bottle comprised the remainder of the top six trash items by weight, and their respective percent of the total weight were 15.4, 13.9, 13.4, 12.4 and 11.8, respectively.

During the survey, tissue paper and paper napkins were frequently observed along curb area. In addition, both middle and high school-aged children were frequently observed playing in the parking lot areas.

Figure 39 - Silver Spruce Townhouses (LPB-SDR1)

Figure 40 - Silver Spruce Townhouses - Top Six Trash Items By Count

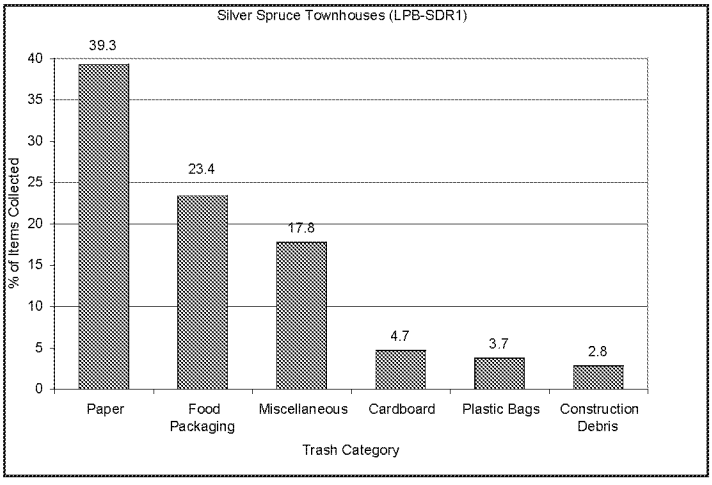
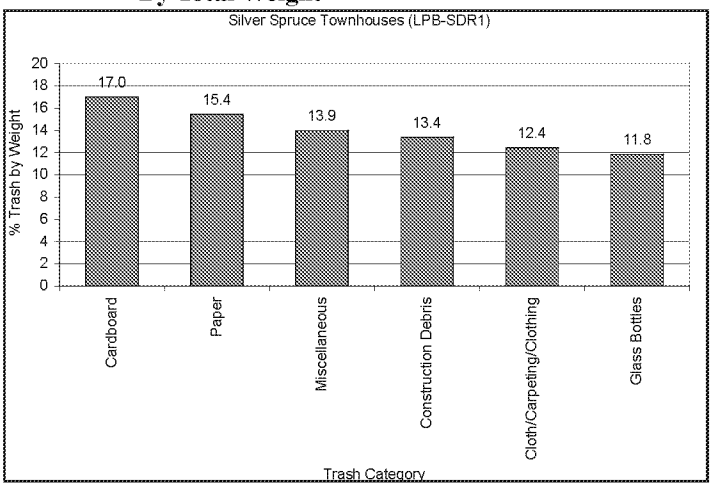


Figure 41 - Silver Spruce Townhouses - Top Six Trash Items By Total Weight



3.2.4 Kirkwood Apartments (NWB-SDR2) - High Density, Residential Garden Apartments

The Kirkwood Apartments site is representative of high density residential garden apartment land uses present in the Lower Northwest Branch subwatershed in Prince George's County (Figure 42). The number of trash items counted for the survey period totaled 115. Of the top six items by count, paper, miscellaneous items, and food packaging were the top three trash items, and accounted for 39.1, 21.7, and 17.4 percents of the total items, respectively. Aluminum cans, plastic bottles and plastic bags, were the next three items and their percent of the total trash items, by count, were 11.8, 5.9 and 5.1 percent, respectively (Figure 43). Based on the ATRW trash index, trash levels were in the 'light' range (i.e., 10.1 - 25.0).

The weight of all the trash items collected totaled 2.1 pounds. Miscellaneous items weight, the second most common item at the Kirkwood Apartments site, accounted for 30.5 percent of the total site weight. Cardboard, aluminum cans, plastic bottles, paper and cloth/clothing/carpeting, comprised the remaining bottom three trash items (by weight) and their percent of the total weights were 20.4, 15.9, 10.4, 8.4, and 7, respectively (Figure 44).

During the survey, it was observed that Kirkwood Apartments maintenance facility staff conduct daily roadside and parking lot trash pickups on apartment property (i.e., along both Nicholson Lane and Mall Road). This strongly suggests that the litter problem here is higher than what is supported by the data. In addition, along the Nicholson Lane road right-of-way, M-NCPPC staff was observed conducting similar but weekly trash removal. This further suggests that this area has been identified as a high litter problem area.

Figure 42 - Kirkwood Apartments (NWB-SDR2)

Figure 43 - Kirkwood Apartments - Top Six Trash Items By Count

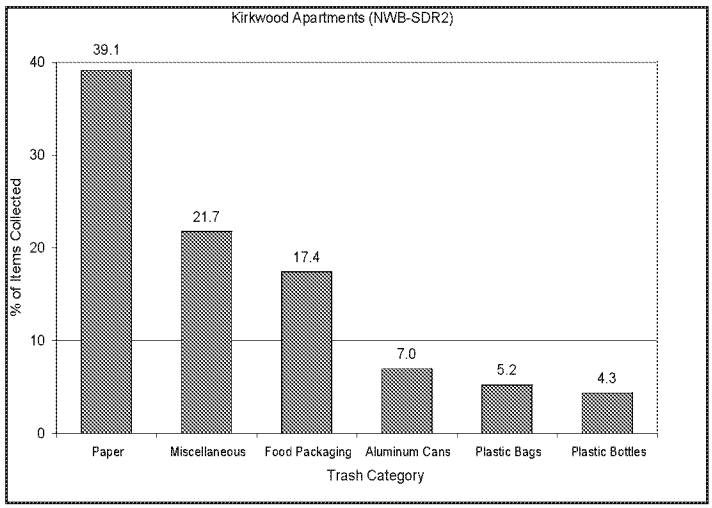
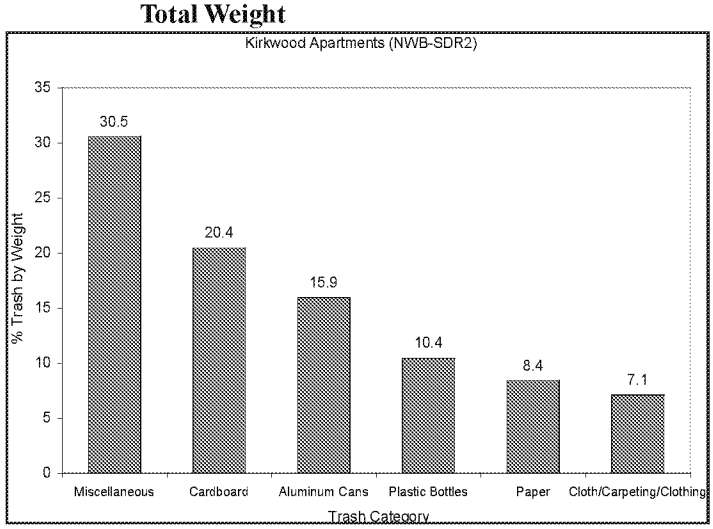


Figure 44 - Kirkwood Apartments - Top Six Trash Items By Total Weight



3.2.5 Kemp Mill Shopping Center (SC-SDR1) - Commercial

Kemp Mill Shopping Center site is representative of commercial land uses present in the upper Sligo Creek subwatershed in Montgomery County (Figure 45). The actual survey site was part of the Magruder's supermarket parking lot. The number of trash items counted during the survey period totaled 343, which was the second highest total among all six sites. Of the top six items counted, paper (28.9 percent), food packaging (25.9 percent), and plastic bags (19.0 percent) were the top three percents. Aluminum cans (10.8 percent), Styrofoam (6.7 percent), and miscellaneous items (3.8 percent) were the remaining three items (Figure 46). It should be noted that the top item collected (i.e., paper) was typically discarded tissues, crumpled up paper napkins and paper towels. Based on the ATRW trash index, trash levels were in the 'high' range (i.e., > 50.1 items).

The weight of all the trash items totaled 3.9 pounds. Construction debris was the top item by weight, accounting 27.4 percent of the total weight. Ten construction debris items were collected, with the largest piece (i.e., lumber) weighing 0.7 pounds. In descending order, food packaging, paper, plastic bags, miscellaneous items, and aluminum cans completed the remaining top six items. The percent of the total weight for these items was 19.6, 18.2, 16.6, 6.3, and 5.2, respectively (Figure 47).

As a general observation, the entire parking lot appeared to be relatively clean and well-maintained. While no street sweeping machinery was ever observed, it is assumed that the commercial establishments participate in some form of trash/litter removal.

Figure 45 - Kemp Mill Shopping Center (SC-SDR1)

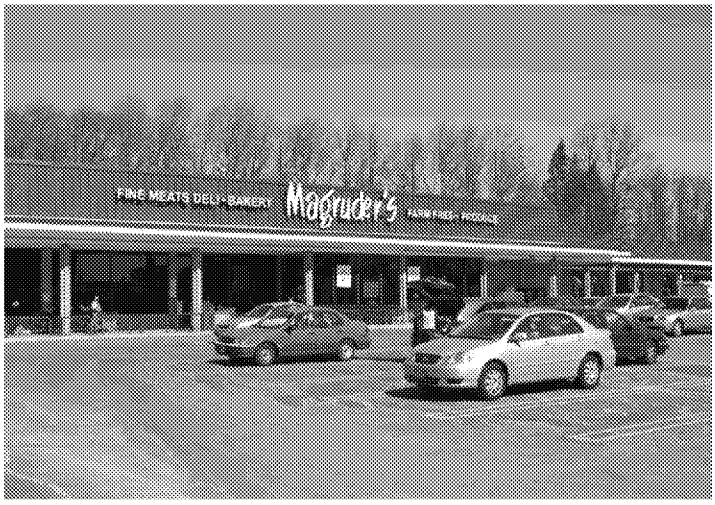


Figure 46 - Kemp Mill Shopping Center - Top Six Trash Items By Count

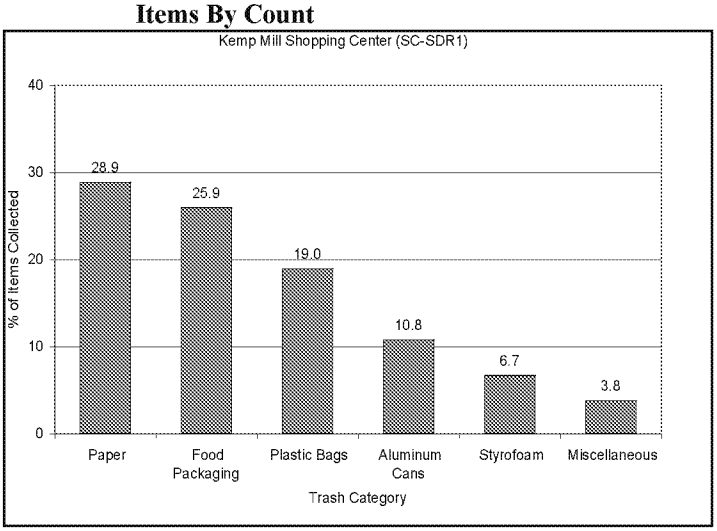
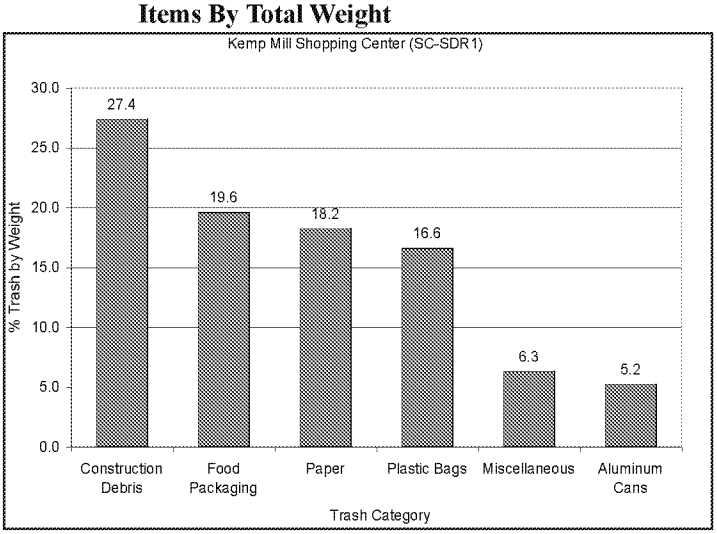


Figure 47 - Kemp Mill Shopping Center - Top Six Trash Items By Total Weight



3.2.6 Beltsville Industrial Park (IC-SDR1) - Industrial

The Beltsville Industrial Park site is representative of industrial land uses present in the Upper Indian Creek subwatershed in Prince George's County (Figure 48). The number of trash items counted for the survey period totaled 497, a survey high. Of the top six items counted, miscellaneous items (26.4 percent), food packaging (18.5 percent), and paper (17.3 percent) were the top three items. Plastic bottles (12.9 percent) and aluminum cans (6.2 percent), and metal items (4.4 percent) were the remaining three items that comprised the top six (Figure 49). Based on the ATRW trash index, trash levels were in the 'high' range (i.e., > 50.1 items).

The weight of all the trash items collected totaled 39.1 pounds, also a survey high. Construction debris was the top item by weight. It accounted for 18.0 percent of the total weight and was followed closely by metal items (17.4 percent) and auto parts (16.3 percent). It should be noted that: 1) the 19 pieces of auto parts collected (i.e., comprising less than four percent of the total number of items collected) accounted for less than four percent of the items collected by weight and 2) one auto part weighed over four pounds. Plastic bottles (10.4 percent), glass bottles (10.3 percent), and construction debris (5.7 percent) were the remaining the top six items (Figure 50).

Within the Beltsville Industrial Park area, there appears to be little or no trash/litter removal along the road right-of-ways. It is also apparent that many of the property owners show very little interest in maintaining trash/litter free facilities. Furthermore, Ewing and Tucker roads are major delivery routes and are recipients of trash discarded from passing vehicles. Currently, there is no adopt-a-road program for this industrial park area.

Figure 48 - Beltsville Industrial Park - (Hanna Street) (IC-SDR1)

Figure 49 - Beltsville Industrial Park - Top Six Trash Items By Count

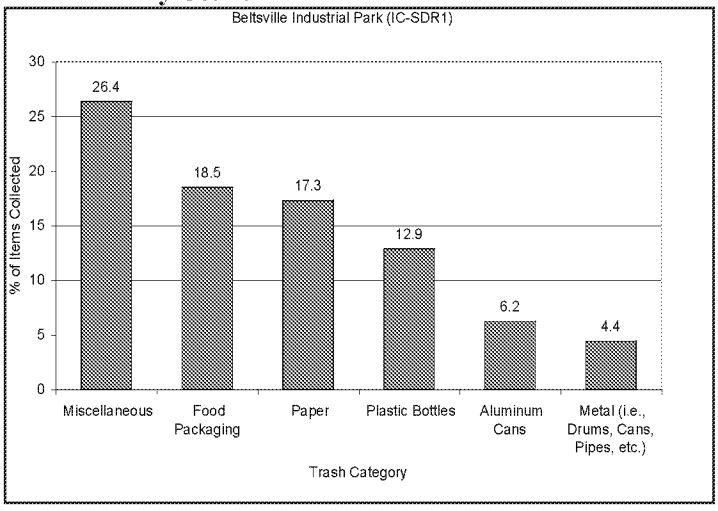
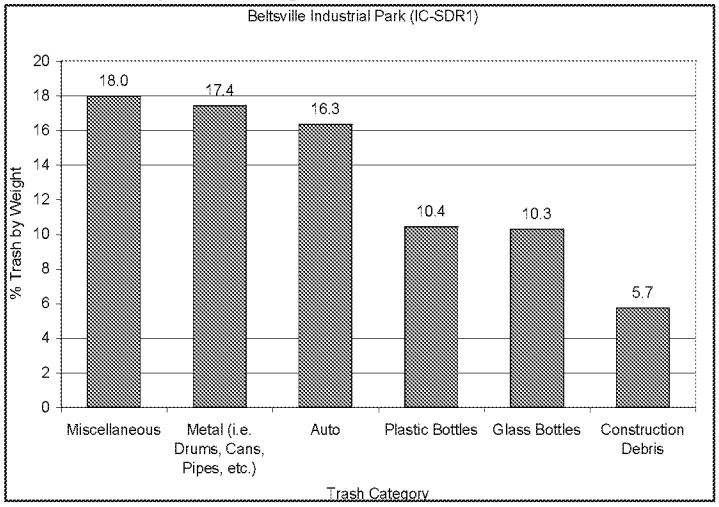


Figure 50 - Beltsville Industrial Park - Top Six Trash Items By Total Weight



3.3 Storm Drain Outfall Monitoring Summary

As previously noted, each of the six road and parking lot trash monitoring sites featured companion storm drain outfall monitoring. These six storm drain outfalls were targeted for trash load monitoring based on land uses that are representative of those present in the Anacostia watershed. They included: low-density residential (large lot, single family), 2) medium-density residential (small lot, single family) 3) townhouses), 4) high-density residential (garden apartments), 5) commercial and 6) industrial land uses.

Table 7 - Storm Drain Outfall Survey Sampling Date and Rainfall Summary[1]

	Sample Date	Number of Sample Days[2]	Total Precipitation (in)	Mean Intensity (in/hr)	Maximum Intensity (in/hr)[3]
1.	10/27/2008	9	0.64	0.06	0.41
2.	12/11/2008	17	2.25	0.05	0.48
3.	1/30/2009	22	0.80	0.04	0.24
4.	3/9/2009	26	0.28	0.02	0.08
5.	3/31/2009	22	1.33	0.03	0.24
6.	4/21/2009	11	2.11	0.04	0.24
7.	5/5/2009	7	1.53	0.05	0.20
8.	6/22/2009	7	1.61	0.09	0.88
9.	7/27/2009	25	0.88	0.10	0.80

[1] Rainfall data collected from USDA BARC facility Station # 7; DCA rainfall was used for 5/5/2009 due to the incompleteness of the USDA BARC data for May 2009.
[2] Number of sample days indicates the number of days that the trash fence is in the 'closed', collecting trash position.
[3] Extrapolated from 15 minute USDA BARC rainfall data. For 5/5/2009, actual DCA rainfall inch/hour was used.

Table 7 provides a 'snapshot' of precipitation levels associated with the nine storm drain outfall monitoring dates which spanned over four seasons (i.e., fall 2008, winter 2008/09, spring 2009 and summer 2009). Generally, monitoring was performed after a period of at least 0.25 inches of total rainfall. The number of days that the trash fences were left in the "closed" position ranged from seven to 26 days. The highest amount of precipitation recorded (2.16 inches) occurred in December 2008 and the lowest (0.28 inches) in March 2009. The maximum rainfall intensity observed was recorded on June 20, 2009 (0.88 inches per hour). Excluding this one event, the maximum intensity ranged from 0.08 to 0.80 inches per hour.

Table 8 summarizes the storm drain trash total items by count, the trash pounds per acre and the organic weight fraction. The total number of trash items (counted and sorted to the 20 trash categories) was 2,913. The associated total weight was 154.5 pounds. The top six items by count, in descending order, were Styrofoam, food packaging, plastic bags, plastic bottles, miscellaneous items, and aluminum cans. It should be noted that with the exception of the miscellaneous items, the storm drain outfall top six trash items by count were similar to that of the stream channel survey's top trash items by count. The associated top six items by weight were plastic bags, plastic bottles, Styrofoam, miscellaneous items, food packaging and construction debris. The total organic weight was 912.8 pounds and the organic weight to trash weight ratio was approximately 6:1.

Figure 51 - Summary - Storm Drain Trash and Organic Debris Loads per Sampling Date

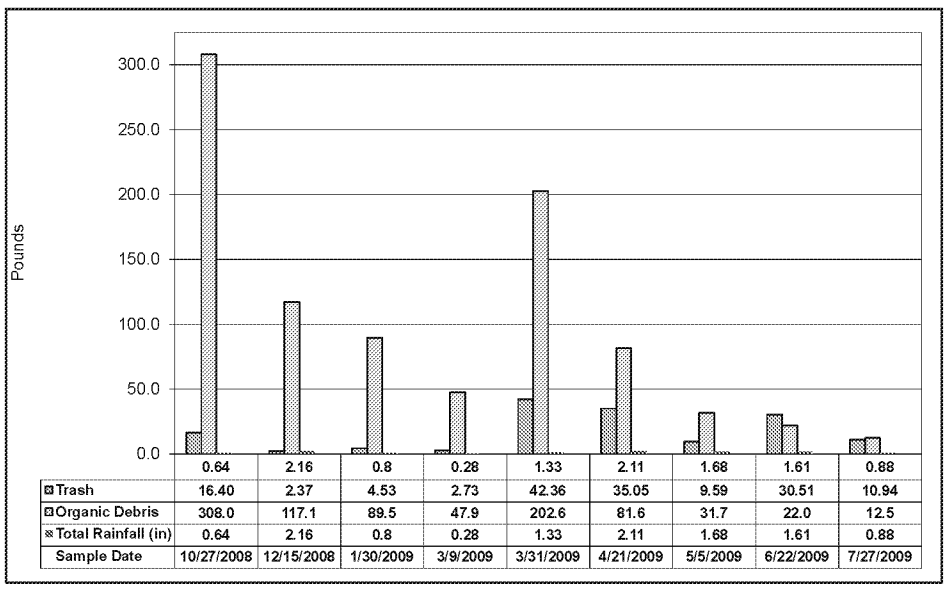


Figure 51 illustrates the seasonal variation in total trash and organic debris weights, in pounds, for each of the nine sample dates. In general, trash levels tended to increase from the winter months (i.e., December 2008 - January

Table 8 - Summary - Storm Drain Outfall Survey Trash Items[1] Count and Trash and Organic Debris Weights

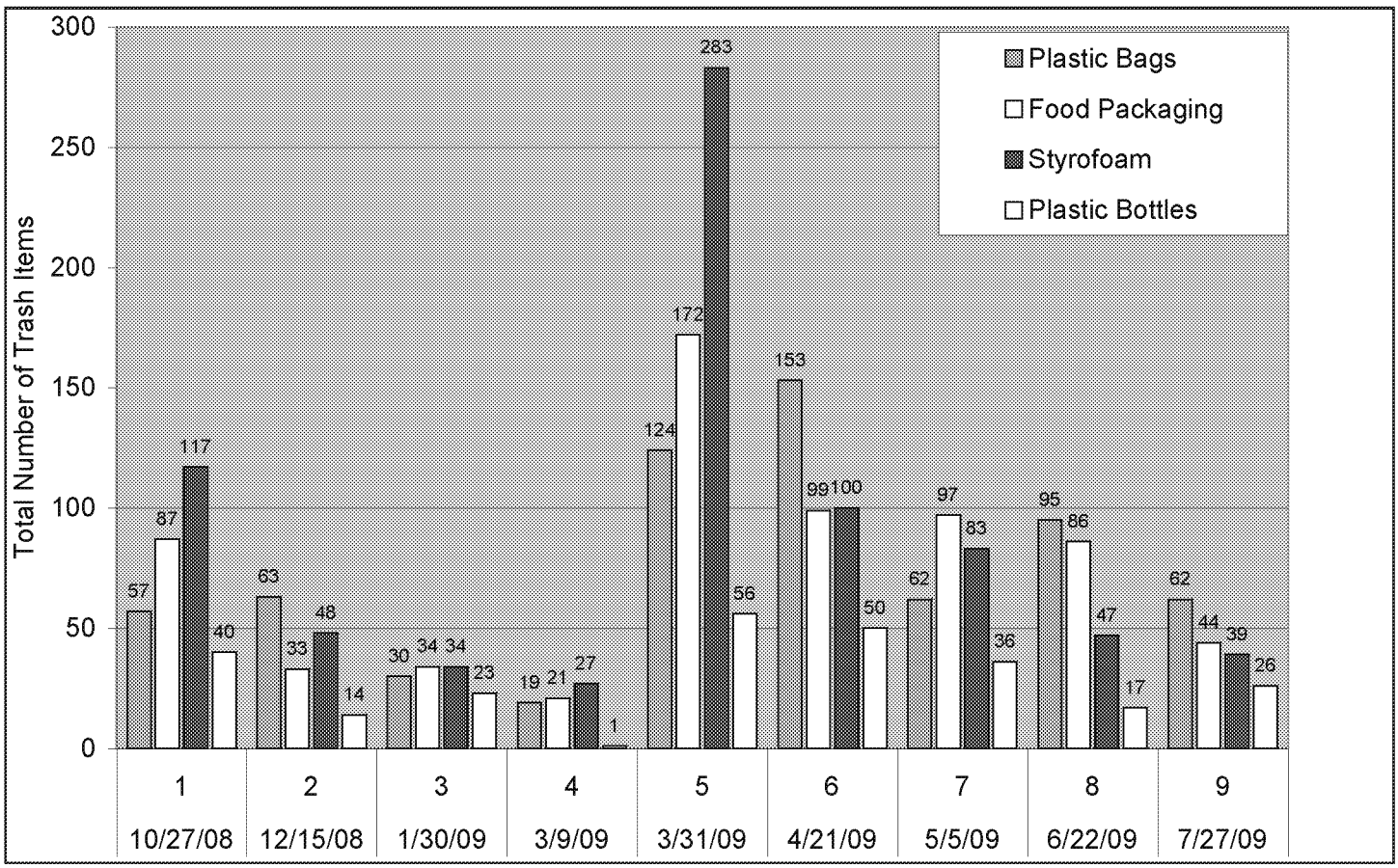
Site ID	Site Description (Jurisdiction)	Dominant Land use Type	Drainage Area (acre)	Items Counted				Weight				Organic		Total Organic to Trash Weight Ratio
				Total	Top 6 Categories		Items per acre	Total (lbs)	Top 6 Categories		Weight per Acre	Total Organic Weight (lbs)	Organic Weight per Acre	
					Top 3	Next 3			Top 3	Next 3				
NWB-SD1	Baughman Drive and Baughman Court (MCCO)	Low-Density Residential (large lot, single family) (99%)	6.9	21	9, 1, 2	6, 5, 4	3.0	2.3	13, 19, 1	20, 4, 6	0.3	42.9	6.2	18:1
SC-SD2	Raydale and Dayton Roads - Raydale Road Tributary (PGCO)	Medium Density Residential (small lot, single family, and/or townhouses) (76%)	65.2	810	9, 5, 1	20, 3, 2	12.4	50.4	1, 20, 2	16, 9, 4	0.8	173.7	2.7	3:1
LPB-SD1	Silver Spruce Circle - Silverwood Tributary (MCCO)	Medium Density Residential (small lot, single family, and/or townhouses) (100%)	2.3	195	9, 1, 2	5, 6, 20	84.8	12.0	19, 2, 9	8, 1, 4	5.2	133.8	58.2	11:1
NWB-SD2	Kirkwood Apartments - Nicholson Lane and The Mall Road (PG CO)	High Density Residential (apartments) (100%)	3.1	144	9, 1, 6	20, 5, 2	46.5	3.9	3, 2, 20	1, 9, 4	1.3	27.2	8.8	7:1
SC-SD1	Kemp Mill Shopping Center - Magruder's Supermarket Parking Lot (MCCO)	Commercial (100%)	4.2	98	6, 9, 1	3, 20, 4	23.3	1.5	1, 3, 9	2, 20, 4	0.4	98.7	23.5	65:1
IC-SD1	Beltsvile Industrial Park - Hanna Road (PGCO)	Commercial/Industrial (57%)	226.0	1,645	5, 1, 9	2, 4, 20	7.3	84.2	1, 5, 2	9, 13, 4	0.4	436.5	1.9	5:1
				2,913	5,9,1	2,20,4		154.5	1,2,5	20,9,13		912.8		

[1] Trash Item Categories:
1) Plastic Bags 2) Plastic Bottles; 3) Glass Bottles; 4) Aluminum Cans; 5) Styrofoam (cups, packaging etc.); 6) Paper (newspaper, magazines, etc.); 7) Cardboard; 8) Cloth/ Clothing/Carpeting; 9) Food Packaging; 10) Auto (a) Oil Quart Containers; b) Oil Filters Antifreeze; c) Containers d) Body Parts Large >1ft^2; and e) Body Parts Small <1ft^2); 11) Car Batteries; 12) Tires (Cars, Truck); 13) Construction Debris: (a) Bricks (>1/2 brick); b) Concrete; c) Lumber; and d) Misc. (e.g. dry wall, etc)); 14. Appliances; 15) Wooden Pallets; 16) Metal (Drums, Cans, Pipes, etc.); 17) Shopping Carts; 18) Toiletries/Drug Containers; 19) Sports Equipment/Toys; and 20) Miscellaneous.

2009) to the spring and summer months (i.e., March - July 2009). As expected, the organic debris levels tended to slowly decrease after the fall season (i.e., October - December 2008, leaf-fall period). However, an increase in both trash and organic debris levels was observed for the March 31 2009 sample. This is attributable to multiple factors including both higher precipitation and rainfall intensity levels.

Four selected floatable trash items (i.e., plastic bags, food packaging, Styrofoam and plastic bottles) totaled 2,379 and accounted for over 82 percent of the total trash items counted. These floatable items are shown for each survey sampling date in Figure 52. Importantly, the quantity of the four trash items increased from March 31, 2009 through July 27, 2009. During this period, the count for these four items totaled 2,104 or 72 percent of the total. Similar conditions were observed for the spring 2008 and summer 2009 stream survey data, as total trash counts were both greater than those for winter 2009. It is expected that with normal rainfall patterns during the warmer months of the year, that trash levels increase in both the storm drain outfall and stream areas. For additional storm drain outfall data, the reader is referred to Appendix 5.

Figure 52 - Selected Floatable Trash Items per Sample Date By Count



While only limited cigarette butt surveying was performed, cigarette butts were only observed at the Raydale Road (medium density residential area), Kemp Mill Shopping Center (commercial area), and the Beltsville Industrial Park storm drain outfall sites. The total number of cigarette butts counted was 255. Of this total, 189 (84 percent) were associated with the Beltsville Industrial Park, 21 (10 percent) at the Kemp Mill Shopping Center and site 15 (6 percent) at the Raydale Road (medium density residential area).

3.3.1 Trash Fence One-Inch Diameter Opening "Sub-sampler"

As previously mentioned, the one-inch diameter opening sub-sampler was attached to all six trash fences. The purpose of installing the sub-sampler was to determine the relative effectiveness of the trash fences at capturing smaller trash items (i.e., less than 2-inches in diameter). The results indicate that the trash fences were very efficient at capturing all trash items, even those less than 2-inches in diameter.

Figure 53 shows the total number of items captured by the sub-sampler per site. A total of ten trash pieces (less than 1 percent of the total trash items collected) were collected inside the sub-sampler. The items included, four small Styrofoam pieces (Figure 54), three paper pieces, two plastic bag slivers and one plastic miscellaneous item. It is important to note that the storm drain outfall stormwater discharges contain both trash and organic debris. As this water reaches the trash fence and begins to rise, both trash and organic debris are effectively strained out by the 2-inch diameter openings in the chain link fence; thus, capturing the majority of the trash items (Figure 55). It should be noted that frequent regular maintenance of the trash fence (including the removal of the organic debris) was essential for maintaining the fence's operation.

Figure 53 - Summary - Trash Fence and "Sub-sampler" Number of Items by Count

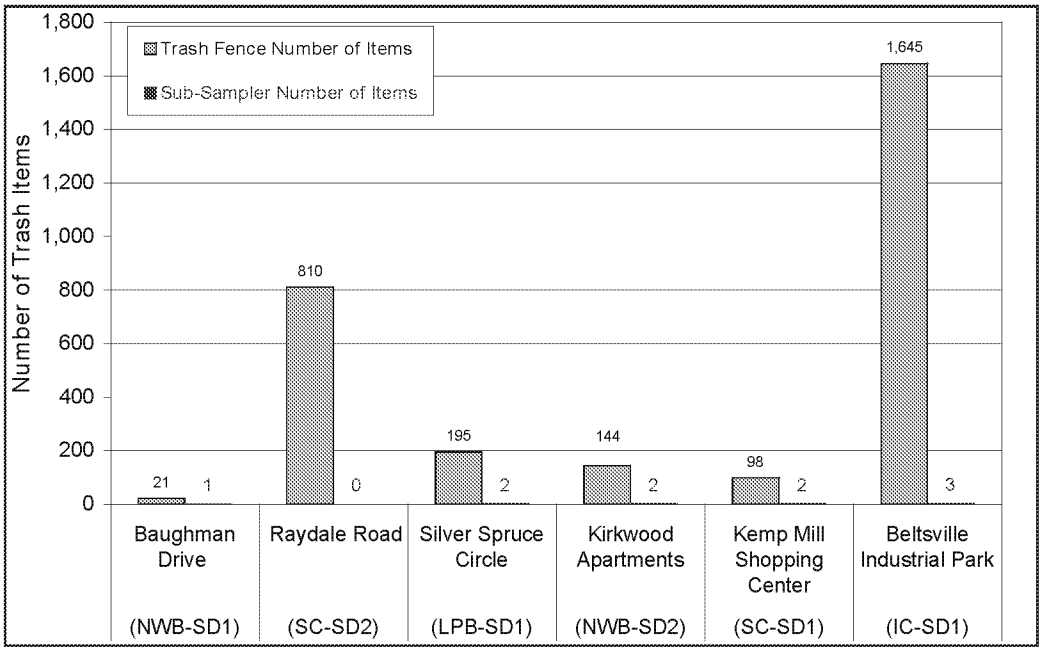


Figure 54 - Sub-Sampler Captures a Styrofoam 'Peanut'

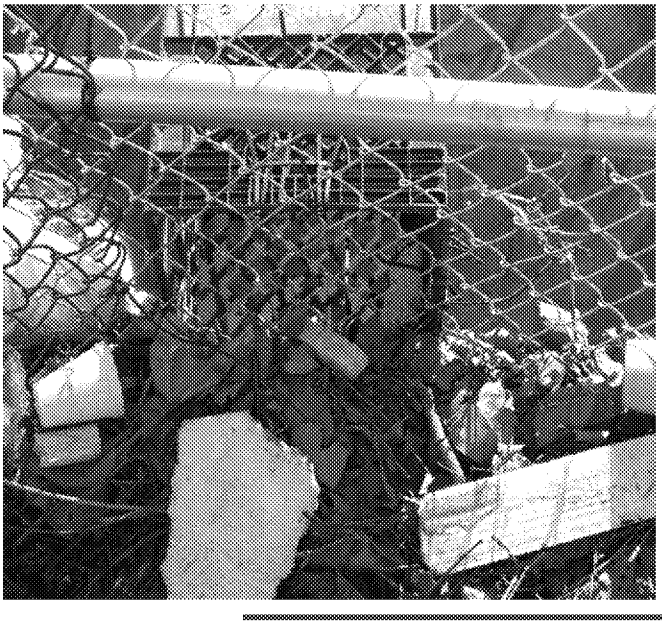


Figure 55 - Trash and Debris Accumulation on the Trash Fence

3.3.2 Baughman Drive - Low Density, Single Family Residential

Throughout the study period this 6.9 acre low density residential site generated, from both a by item count and weight perspective, the lowest total amount of trash (i.e., 21 items, 2.3 pounds). Not surprisingly, the pounds of trash generated per acre ratio for Baughman Drive (i.e., 0.3:1) was the lowest among the six trash fence sites. It should be noted that for this relatively small drainage area, a smaller 'removable' fence was employed (Figure 56).

The top six items counted at Baughman Drive were in descending order, food packaging, plastic bags, plastic bottles, paper, Styrofoam, and aluminum cans. In contrast, the top six items by weight were construction debris, sports equipment/toys, plastic bags, miscellaneous items, aluminum cans, and paper (Figure 57). The major portion of the total trash weight was associated with construction debris (i.e., 63.6 percent) and sports equipment/toys (i.e., 24.7 percent). The percentage of the total weight for the plastic bags, miscellaneous items, aluminum cans, paper and food packaging were as follows: 3.8, 2.5, 2.2, 1.6 and 1.6, respectively. The organic debris fraction collected at this site totaled 42.9 pounds and was approximately 95 percent of the total weight (Figure 58). The ratio of organic debris to trash, by weight, was approximately 18:1.

As previously mentioned in the road survey section, the Baughman Drive neighborhood is extremely well-kept.

Figure 56 - Baughman Drive Trash Fence

Figure 57 - Baughman Drive - Top Six Trash Items by Total Weight

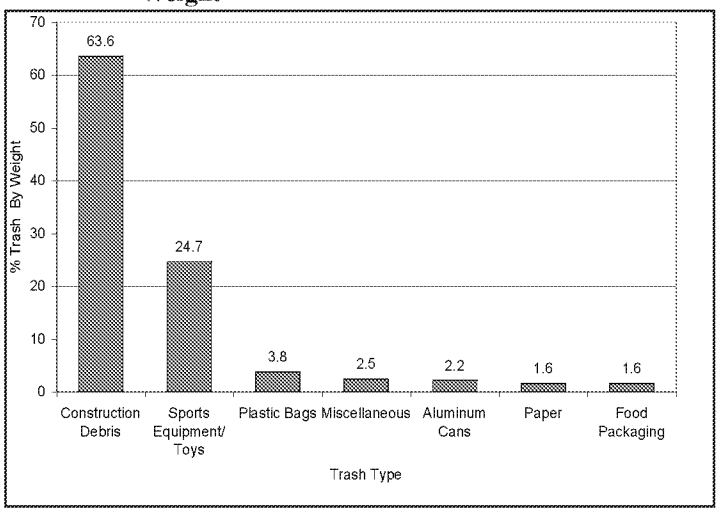
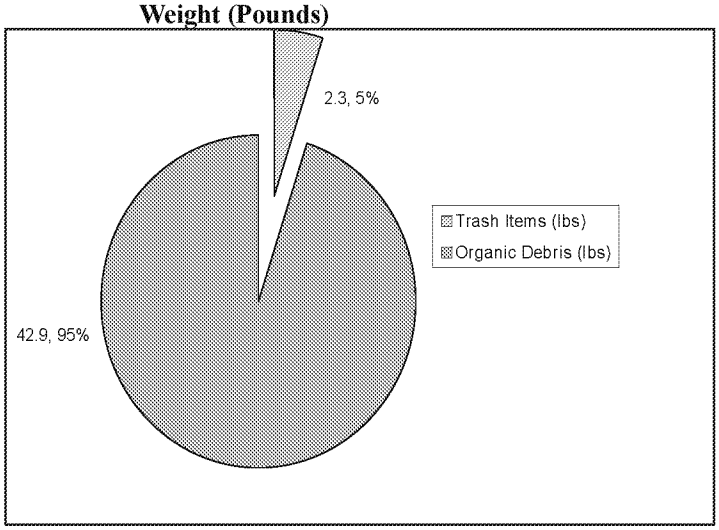


Figure 58 - Baughman Drive - Trash and Organic Debris by Weight (Pounds)



3.3.3 Raydale Road - Medium Density, Single Family Residential

The drainage area associated with the Raydale Road trash fence (approximately 65.2 acres) was, after the Beltsville Industrial Park, the second largest among the six sites. As seen in Figure 59, the Raydale Road trash fence consisted of a single, heavy duty steel, ten foot-long, hinged gate featuring two-inch diameter breakaway chain link fencing. This breakaway feature was intentionally employed so as to allow higher discharge storm flows to be safely passed through the fence area without damaging either the gate posts and/or gate framing. During the study, a total of 810 trash items weighing 50.4 pounds were collected from the site (i.e., the second highest trash level among the six storm drain outfall sites). Not surprisingly, the pounds of trash generated per acre ratio for Raydale Road (i.e., 0.8:1) was also the second highest among the six sites.

The top six trash items counted at Raydale Road were, in descending order, food packaging, Styrofoam, plastic bags, miscellaneous items, glass bottles and plastic bottles. The top six trash items by weight were plastic bags, miscellaneous items, plastic bottles, metal items, food packaging, and aluminum cans (Figure 60). The total trash weight percentages for the preceding items were as follows: 22.8, 21.2, 13.8, 12.2, 8.4, and 6.9 percent, respectively. The leafy organic debris weight collected at this site totaled 173.7 pounds (Figure 61), which represented 78 percent of the total weight. The ratio of organic material to trash, by weight, was 3:1.

'Windshield' surveys performed by COG staff during the study for the surrounding Chillum-Ray neighborhood revealed that the side road areas (above Redtop Road) in this single family residential area were relatively trash free. However, trash levels along portions of Riggs, Ray and Raydale Roads were in the light to high range; strongly suggesting that these road areas contribute the major portion of the trash load delivered to the Raydale Road storm drain system. It should be noted that Riggs Road is a major arterial road with both institutional and fast food commercial land use areas, and that Ridgecrest Elementary School is also located at the intersection of Ray and Riggs Roads. Based on a 1999 COG Riggs Road trash survey, trash levels there were rated as being high (i.e., > 50 items per 100 feet). Current conditions appear to have remained relatively unchanged. Ray Road is a ma-

Figure 59 - Raydale Road Trash Fence

Figure 60 - Raydale Road - Top Six Trash Items by Total Weight

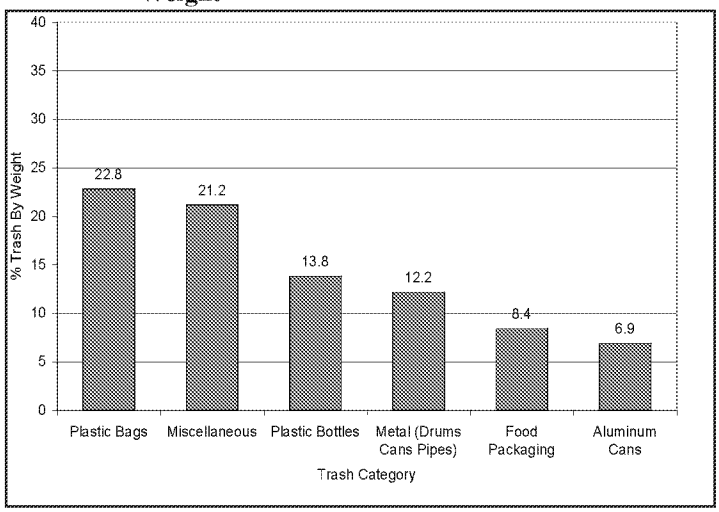
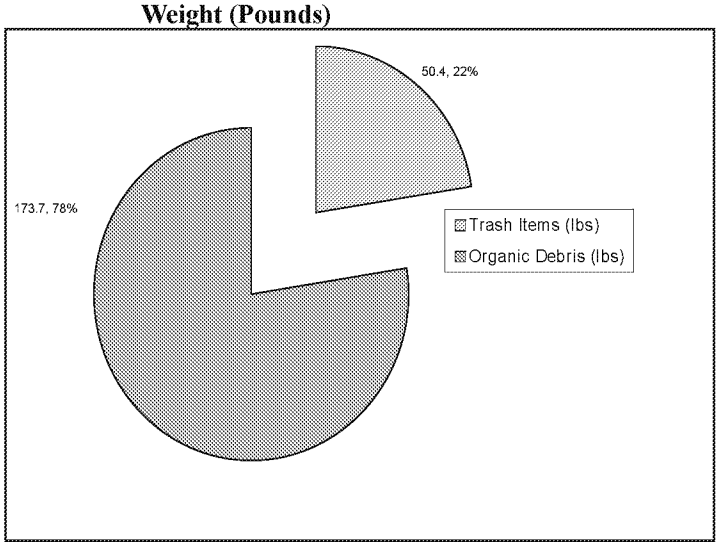


Figure 61 - Raydale Road - Trash and Organic Debris by Weight (Pounds)



jor neighborhood "cut through" street. It too presently receives significant amounts of trash thrown from passing vehicles and is heavily littered by pedestrians. In addition, based on a 2006 COG roadside trash survey, major portions of Ray Road had trash levels in the high range. Trash level conditions along Raydale Road were at the upper end of the light category (i.e., 22.7 items per hundred feet).

3.3.4 Silver Spruce Townhouses - Medium Density, Residential Townhouses

At 2.3 acres, the Silver Spruce trash fence drainage area was the survey's smallest. During the study, a total of 195 trash items weighing 12.0 pounds were collected from this site (i.e., the third highest trash level among the six storm drain outfall sites). Much to COG staff surprise, the pounds of trash generated per acre ratio for the Silver Spruce townhouses (i.e., 5.2:1) was the highest among the six sites.

The top six trash items counted at the Silver Spruce site were, in descending order, food packaging, plastic bottles, plastic bags, Styrofoam, paper, and miscellaneous items (Figure 62). The top six trash items by weight were sports equipment/toys, plastic bags, food packaging, cloth/clothing/carpeting, plastic bottles, and aluminum cans (Figure 63). 34.8 percent of the total weight was represented by the sports equipment/toys trash category. The total trash weight percentages for the preceding items were as follows: 7.6 percent (plastic bottles), 5.2 percent (food packaging), 4.7 percent (cloth/carpeting/clothing), 4.4 percent (plastic bags), and 2.3 percent (aluminum cans). The leafy organic material weight collected at this site totaled 133.8 pounds. This represented 92 percent of the total weight (Figure 64). The ratio of organic material to trash, by weight, was 11:1.

As previously noted, during the survey period it was observed that middle and high school-aged children were frequently playing in the townhouse parking lot areas.

Figure 62 - Silver Spruce April 2009 Trash Survey

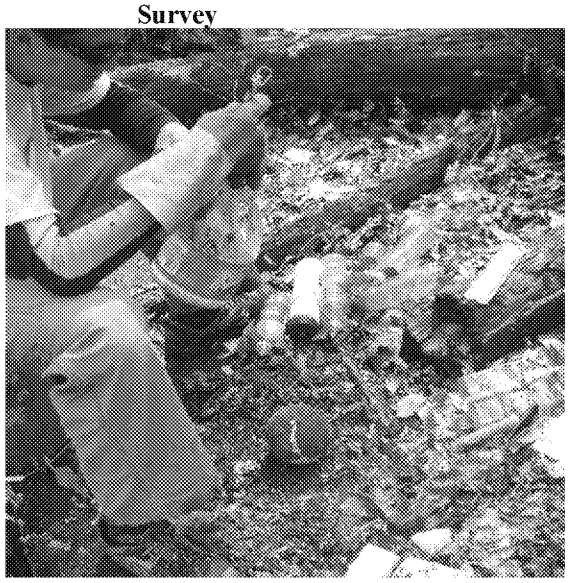


Figure 63- Silver Spruce Townhouses - Top Six Trash Items by Total Weight

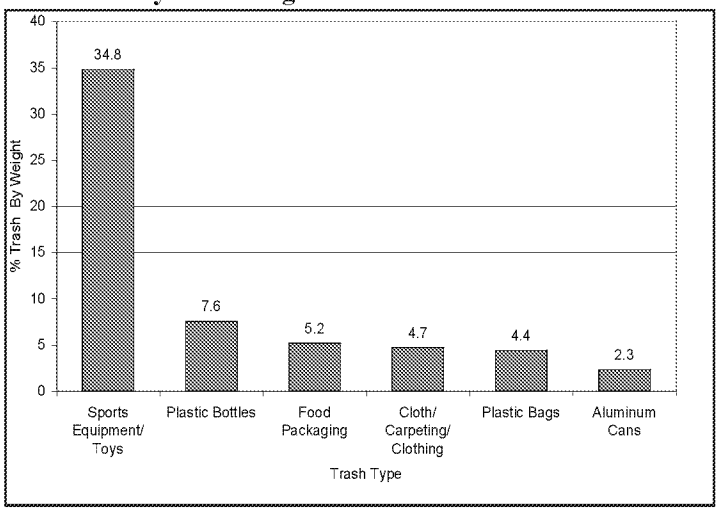
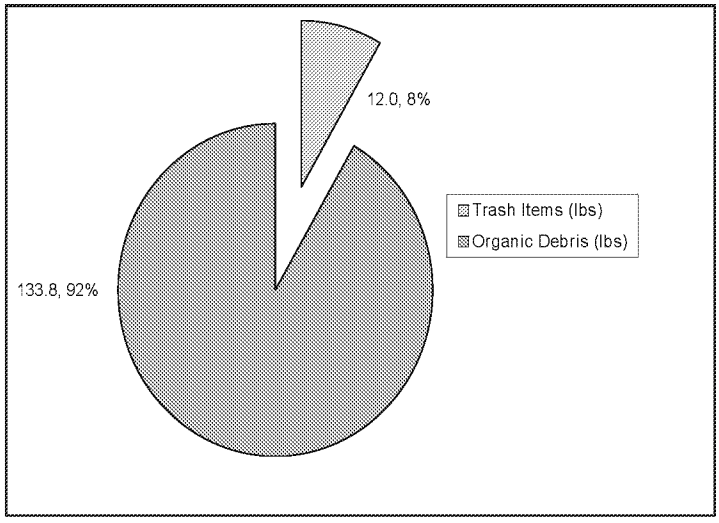


Figure 64 - Silver Spruce Townhouses - Trash and Organic Debris by Weight (Pounds)



3.3.5 Kirkwood Apartments - High Density, Residential Garden Apartments

With an associated drainage area of 3.1 acres, the Kirkwood Apartments trash fence site (Figure 65) was among the smaller sites monitored. During the study, a total of 144 trash items weighing 3.9 pounds were collected there (i.e., the fourth highest trash level among the six storm drain outfall sites). The pounds of trash generated per acre ratio for the Kirkwood Apartments (i.e., 1.3:1) was the second highest among the six sites.

The top six trash items counted at the Kirkwood site were, in descending order, food packaging, plastic bags, paper, miscellaneous items, Styrofoam, and plastic bags. The top six items by weight were glass bottles, plastic bottles, miscellaneous items, plastic bags, food packaging and aluminum cans. The total trash weight percentages for the preceding items were as follows: 32.0, 18.8, 11.6, 10.6, 8.8 and 8.4 percent, respectively (Figure 66). The leafy organic material weight collected at this site totaled 27.2 pounds (Figure 67), which represented 87 percent of the total weight. The ratio of organic material to trash, by weight, was 7:1.

As previously indicated in the road survey portion of the study, it was observed that Kirkwood Apartments maintenance facility staff perform daily road and parking lot litter patrol/trash cleanups on apartment property (i.e., along both Nicholson Lane and Mall Road). Similarly, along the Nicholson Lane road right-of-way, M-NCPPC conducts weekly trash cleanups. The preceding observations suggest that the actual amount of trash generated from this land use type may in fact be higher than what the monitoring results for both the storm drain outfall and road/parking lot surveys indicate.

Figure 65 - Kirkwood Apartment Trash Fence

Figure 66 - Kirkwood Apartments - Top Six Trash Items by Total Weight

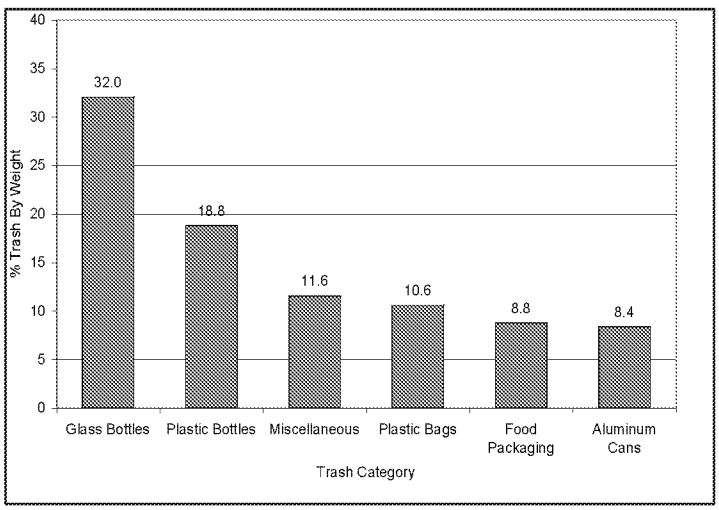
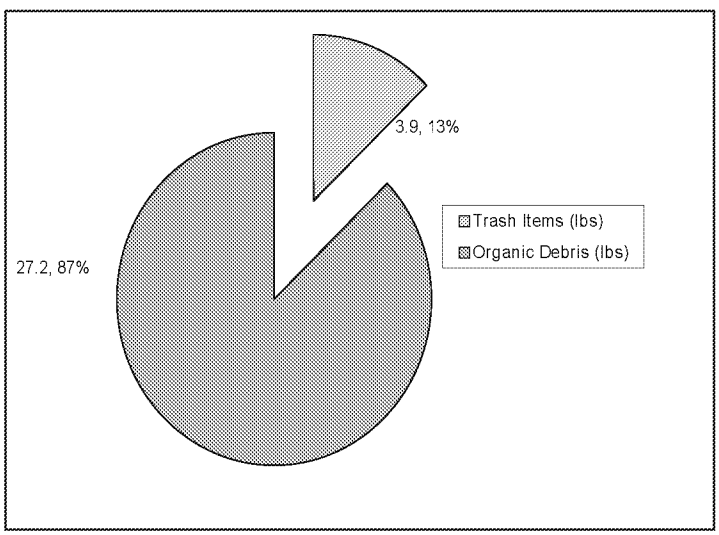


Figure 67 - Kirkwood Apartments - Trash and Organic Debris by Weight (Pounds)



3.3.6 Kemp Mill Shopping Center - Commercial

The Kemp Mill Shopping Center storm drainage area is approximately 4.2 acres. During the study, a total of 98 trash items weighing 1.5 pounds were collected there (i.e., the lowest trash level among the six storm drain outfall sites). The calculated trash pound per acre ratio was 0.4:1. It should be noted that for this relatively small drainage area, a smaller removable trash fence was also employed (Figure 68).

The top six trash items counted at the Kemp Mill Shopping Center site were, in descending order, paper, food packaging, plastic bags, glass bottles, miscellaneous items, and aluminum cans. As seen in Figure 69, the total trash weight percentages for the preceding items were as follows: plastic bags 30.3 percent, glass bottles (18.2 percent), food packaging (17.6 percent), plastic bottles (11.6 percent), miscellaneous items (8.7 percent) and aluminum cans (6.4 percent). The leafy organic material weight collected at this site totaled 98.7 pounds (Figure 70), which represented 98 percent of the total weight. The ratio of organic material to trash, by weight, was 65:1.

As previously mentioned, the entire parking lot area that drains to the storm drain system monitored by COG appears to be relatively well-maintained.

Figure 68 - Kemp Mill Shopping Center Trash Fence

Figure 69 - Kemp Mill Shopping Center Summary - Top Six Trash Items by Weight

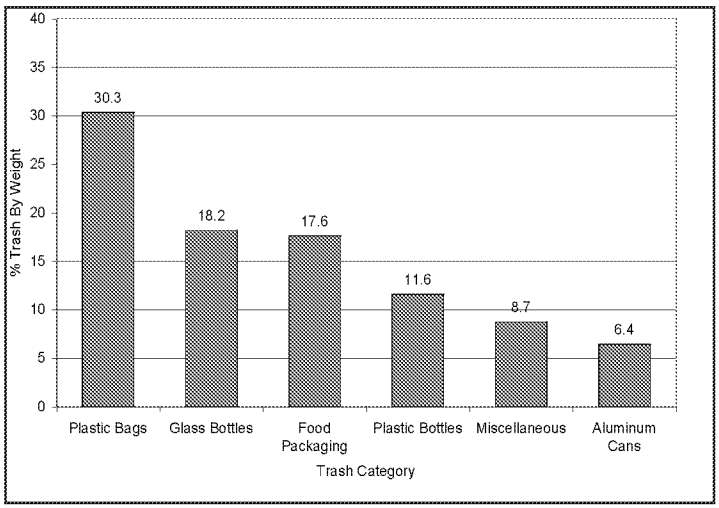
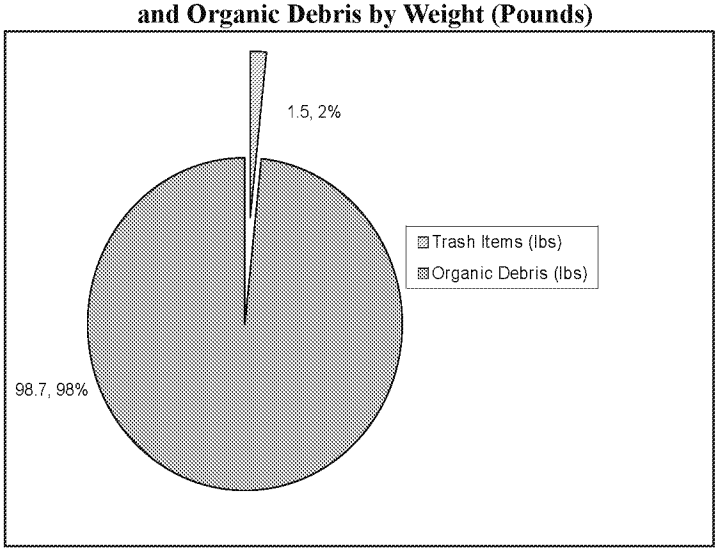


Figure 70 - Kemp Mill Shopping Center Summary - Trash and Organic Debris by Weight (Pounds)



3.3.7 Beltsville Industrial Park - Industrial

Among the six trash fence sites, the Beltsville Industrial Park site had, at 226 acres, the largest associated drainage area. It is a mixed land use area but the predominant land use is industrial/commercial, which comprises approximately 57 percent of the total area. As previously mentioned, this trash fence featured two, large eight foot-long hinged gates, with two-inch diameter breakaway chain link fencing (Figure 71). This design took into account the frequent high intensity storm flows present at the site.

During the study, a total of 1,654 trash items weighing 84.5 pounds were collected there (i.e., the highest trash level, both by count and weight, among the six storm drain outfall sites). The calculated trash pound per acre ratio was 0.4:1.

The top six items by count, from highest to lowest, were Styrofoam, plastic bags, food packaging, plastic bottles, aluminum cans and miscellaneous items. It should be noted that Styrofoam (e.g., packing peanuts, sheets, blocks and spacers) and plastic bags (i.e., bulk packaging and shrink wrap) were generally related to manufacture packaging. As seen in Figure 72, the top six items by weight were in descending order plastic bags (35.9 percent), Styrofoam (14.7 percent), plastic bottles (12.1 percent), food packaging (10.6 percent), construction debris (8.5 percent) and aluminum cans (5.3 percent). The leafy organic material weight collected at this site totaled 436.5 pounds. This represented 84 percent of the total weight (Figure 73). The ratio of organic material to trash, by weight, was 5:1.

As previously noted, the road right-of-ways and many of the businesses within the Beltsville Industrial Park area are not well-kept (Figure 74), and there does not appear to be an adopt-a-road program for this area.

It should be noted that there are two short sections of railroad tracks within the drainage area, the CSX Camden Station rail line and a spur from that line that provides access to the Duron Paint Company property. The trash levels along both of these rail lines are extremely high (Figure 75).

Figure 71 - Beltsville Industrial Park Trash Fence

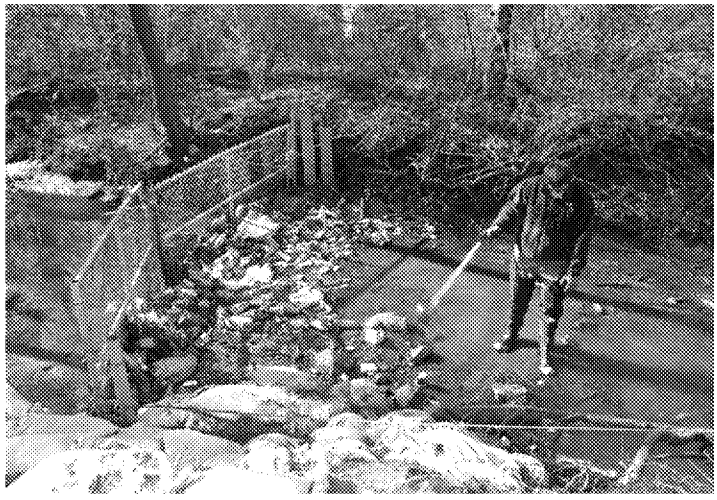


Figure 72 - Beltsville Industrial Park - Top Six Trash Items by Weight

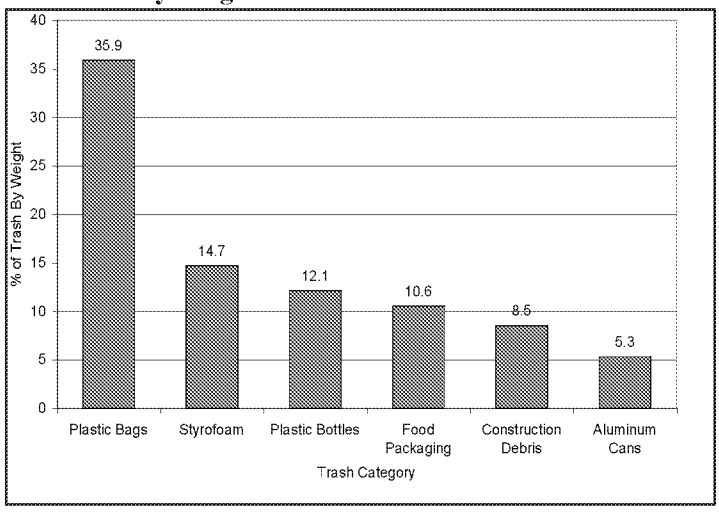


Figure 73 - Beltsville Industrial Park - Trash and Organic Debris by Weight (Pounds)

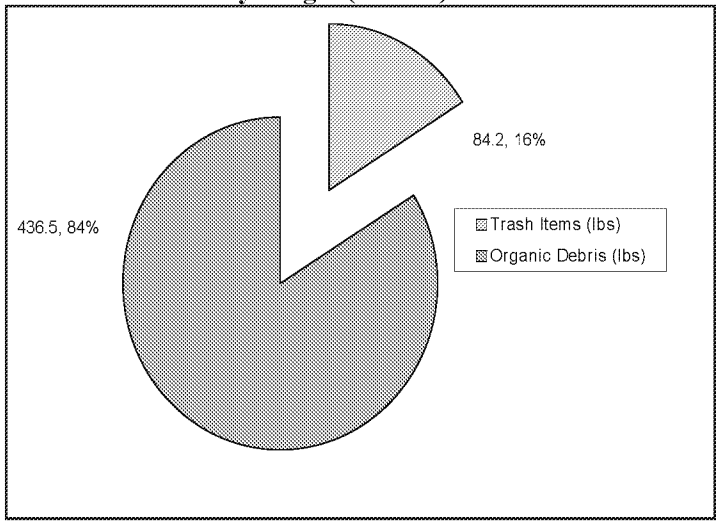


Figure 74 - Beltsville Industrial Park - Hanna Street Private Business Area

Figure 75 - Beltsville Industrial Park - Trash and Debris along the CSX Spur Railroad Area

3.4 Fresh Creek Netting Trashtrap® System Monitoring Summary

Two Fresh Creek Netting Trashtrap® systems, both of which are located in Prince George's County, were surveyed. The 659-acre Ray Road system, which is located in the Takoma Branch, a tributary to the Sligo Creek subwatershed, employs five nets with 0.5-inch openings. The 40.8-acre Flagstaff Street system, which is located in the Lower Beaverdam Creek subwatershed (Figure 76), employs four nets with 0.5-inch openings. It should be noted that due to PGDER maintenance subcontractor time limitations and project budget constraints, only three of the five nets at the Ray Road site and one of the four nets at the Flagstaff Street site were surveyed. For additional Fresh Creek Netting Trashtrap® system, the reader is referred to Appendix 6.

Figure 76 - Lower Beaverdam Creek - COG Staff Surveying Fresh Creek Trashtrap Net Content

Table 9 summarizes the monitoring dates and associated season for each of the Fresh Creek Netting Trashtrap® sites. As shown in Table 9, four surveys were conducted for the Ray Road site and three were conducted for the Flagstaff Street site. It should be noted that the Ray Road site was taken off-line by PGDER from the end of November 2008 through early April 2009, which corresponds with both the heaviest leaf fall period and delivery of this organic material to the nets. Similarly, the Flagstaff Street system was also taken off-line between November 2008 and early May 2009.

Due to severe structural damage caused by a series of high intensity rainfall events, the Ray Road netting system was again taken off-line in early June 2009. No timetable has been set by PGDER for repairing/upgrading the Ray Road system.

Table 9 - Fresh Creek Netting Trashtrap® Survey Sampling Date

Freshcreek Netting Trashtrap Monitoring Task	Fall 08			Winter 08/09			Spring 09			Summer 09		
Ray Road			X					X	X			
Flagstaff Street									X	X	X	
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug

Table 10 summarizes total trash items both by count and by weight for each netting site. In addition, the table summarizes the total amount of organic material (by weight) collected. For the Ray Road netting system, a total of 1,490 trash items weighing 110 pounds were collected there. The top six items by count, from highest to lowest, were food packaging, plastic bags, plastic bottles, Styrofoam, miscellaneous items, and aluminum cans. As seen in Figure 77, the top six items, by weight, were in descending order plastic bags (31.9 percent), food packaging (17.1 percent), plastic bottles (16.9 percent), Styrofoam (7.2 percent), paper (6.9 percent), and aluminum cans (5.4 percent).

The leafy organic material weight collected at this site totaled 4,768 pounds. This represented 98 percent of the total weight, 4,878 pounds (Figure 78). The ratio of organic material to trash, by weight, was 43.5:1.

For the Flagstaff Street netting system, a total of 1,276 trash items weighing 67 pounds were collected. The top six items by count, from highest to lowest, were food packaging, plastic bottles, miscellaneous items, plastic bags, aluminum cans, and paper. The top six items by total trash weight were plastic bottles, paper, cloth/cloth-

Table 10 - Summary - Fresh Creek Netting Trashtrap ® Survey - Trash Items Count and Weight

Site ID	Site Description	Dominant Land use Type	Drainage Area (acre)	Items Counted				Weight						Trash to Organic per acre
				Total	Top 6 Categories		Items per Acre	Total (lbs)	Top 6 Items		Weight per acre	Organic Weight (lbs)	Organic Weight per acre	
					Top 3	Next 3			Top 3	Next 3				
SC-TN	Ray Road and Knollbrook Drive - Hyattsville, MD	Medium Density Residential (small lot, single family homes) (70%)	659.2	**1,490**	9, 1, 2	5, 20, 4	2.3	**110**	1, 9, 2	5, 6, 4	0.2	**4,768**	7	**1:43.5**
LBC-TN	Flagstaff Street at Columbia Place - Landover, MD	High and Medium Density Residential (small lot, single family, and apartments) (99%)	40.8	**1,276**	9, 2, 20	1, 4, 6	31.3	**67**	2, 6, 8	4, 1, 3	1.6	**1,518**	37	**1:22.8**

Figure 77 - Ray Road (Takoma Branch) - Top Six Trash Items by Total Weight

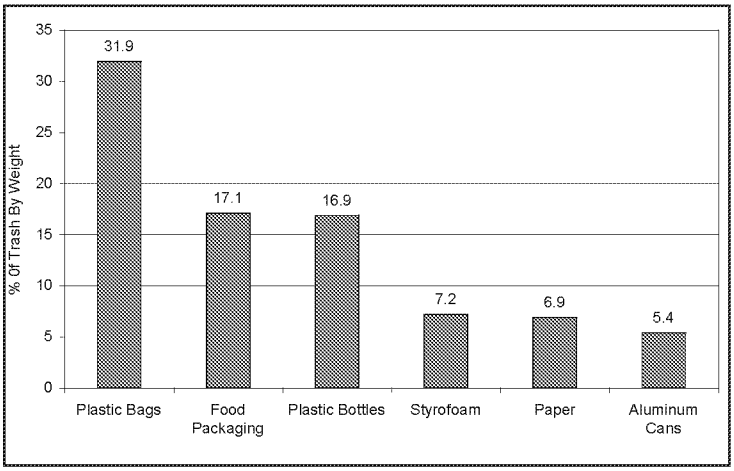
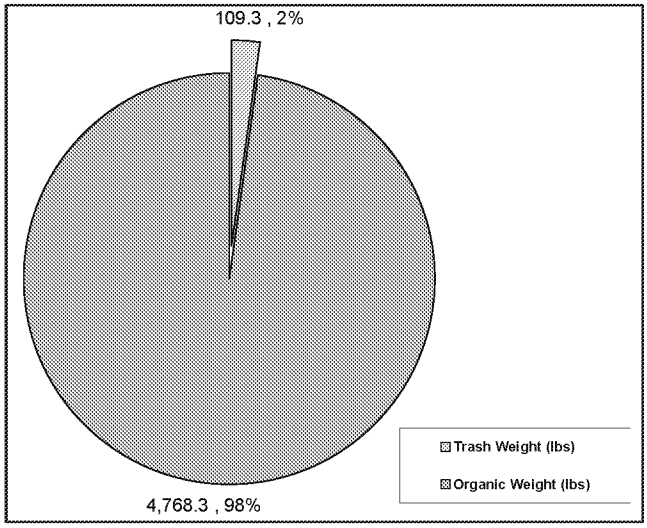


Figure 78 - Ray Road (Takoma Branch) - Trash and Organic Debris Weights (Pounds)



ing/carpeting, aluminum cans, and glass bottles. Figure 79 shows the top six items in percent of total trash weight. For the top items by weight, plastic bottles and paper comprised 19.5 and 15.4 percents, respectively, of the total trash weight. The remaining are as follows: 14.0 percent (cloth/clothing/carpeting), 11.6 (aluminum cans), 8.7 percent (plastic bags), and 7.9 percent (glass bottles).

The leafy organic material weight collected at this site totaled 1,518 pounds. This represented 95 percent of the total weight, 1,585 pounds (Figure 80). The ratio of organic material to trash, by weight, was 22.8:1.

An additional 'windshield' survey was conducted to evaluate the trash levels along the road right-of-ways within the Flagstaff Street netting system drainage area. Generally, the trash levels were in the very light category (0-10.0 items per 100 feet), with a short section of Vermont Avenue and Columbia Place falling into the light category (10.1-25.0 items per 100 feet) (Appendix 6). As previously mentioned, Kent Village Apartment Homes employs storm drain inlet grates for the majority of their inlets. This was not observed for the remaining inlets along the single family residential streets. This suggests that a large portion of the trash items collected at the netting system site are those discarded either on the street or directly into storm drain inlets along the single family residential streets.

Figure 79 - Flagstaff Road (Lower Beaverdam Creek) - Top Six Trash Items By Total Weight

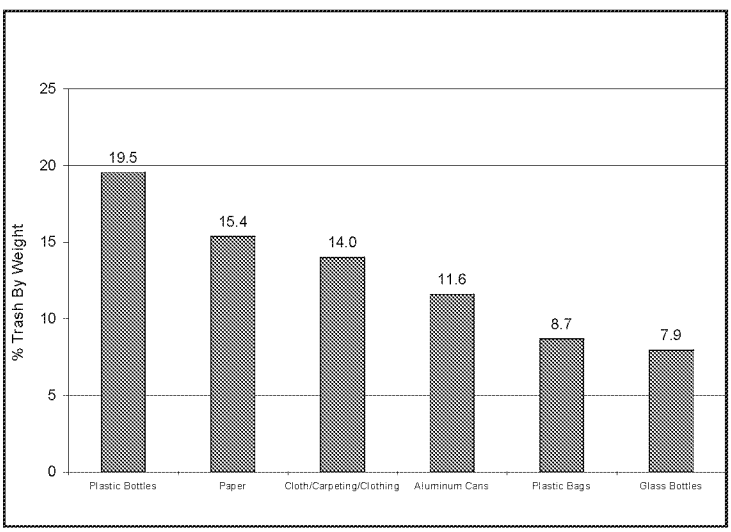
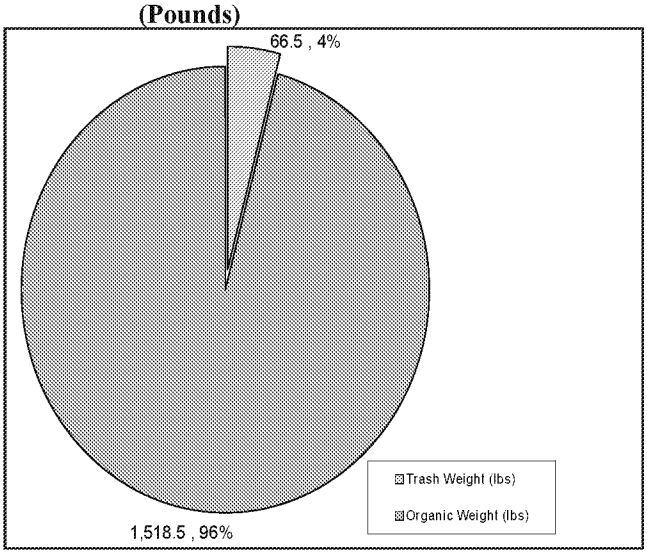


Figure 80 - Flagstaff Street (Lower Beaverdam Creek) - Trash and Organic Debris Weights (Pounds)



4.0 Recommendations

Stream Monitoring

1. Repeat the stream monitoring surveys for the summer and early fall (before leaf fall) seasons, and remove trash from the stream stations as part of each survey. This would provide both needed accumulation rate data and a larger dataset.

Road and Parking Lot Monitoring

1. Continue monitoring the six road and parking lot areas in the current study for one more year. This would provide more representative results and would better account for both annual and seasonal precipitation variations;
2. Conduct a 'mark and recapture' survey for selected road and parking lot areas. This would provide more information as to how floatable trash items enter the watershed's storm drainage systems;
3. Perform a one-year, four season "windshield" survey of major roads within the Maryland portion of the Anacostia watershed (i.e., approximately 500-800 miles). This would provide both badly needed roadway trash level data and help identify "hot spot" areas for subsequent trash removal activities. With proper training to standardize protocols, this could be performed by trained volunteers; and
4. Conduct a comprehensive survey of apartment management firms in the watershed to help better quantify the amount and type of litter/trash removal activities associated with this land use type.

Storm Drain Monitoring:

1. Conduct a 'mark and recapture' survey specifically for the six storm drain outfall sites monitored in the current study and their associated receiving stream areas. As part of this monitoring effort, one or more additional recording rain gauges should be installed. This proposed monitoring effort would provide more information as to how floatable trash items are transported within the Anacostia tributary system.

Fresh Creek TrashTrap® Netting System Monitoring

Recommended Monitoring/Evaluation for the Ray Road Site:

1. The galvanized steel channel frames that hold the bag frames appear to still be serviceable. Install four new, 300 cfs bags; leaving the left (looking upstream) cell open;
2. Install a temporary/experimental flow diversion weir consisting of 2-3, 6" x 6" pressure treated wood posts (or equivalent) bolted in between the existing metal trash net frame. This weir should be about 6" above the invert of the concrete pad to let the Takoma Branch baseflow and some of the sand and gravel bedload flow through;
3. Remove most, if not all of the existing bypass grating system; and
4. Monitor the bags (using different types, including the resin coated ones) and weir for at least 6 months to see if this system really works better than the old one. Also, install a recording rain gauge in the catchment and a pressure transducer in the stream (to determine flow/stage). Only after completing this monitoring should a final decision on next steps (including a possible major rebuild, or a completely new approach) be made.

Montgomery and Prince George's Counties Trash Reduction

1. Both Montgomery County and Prince George's County should investigate working with homeowner associations and community groups in medium density residential areas to reduce litter and trash loadings via the employment of educational outreach and low-cost structural measures, such as storm drain inlet grates. A phased approach whereby community members are first engaged in placing storm drain markers on their inlets, followed by possible installation (by the County or other) of storm drain inlet grates is further recommended; and
2. Prince George's County should strongly encourage private businesses and local groups to 'adopt-a-road' or 'adopt-a-block' within the Beltsville Industrial Park area. In addition, it should explore expanding the current "Four Cities" street sweeping program to include the Beltsville Industrial Park and U.S. Route 1 corridor in Beltsville.